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ALASKA.

By Otto J. Klotz, D.T.S.
(Of the Alaska Boundary Survey).

(*Read before the Ottawa Literary and Scientific Society, February 15, 1894.*)

It was not many years after the discovery of the eastern coast of America that the South Sea or Pacific Ocean was seen by Balboa from the heights of Darien. Balboa was the first European to place foot on the western coast of America.

Sir Francis Drake, the celebrated English admiral, was the first to explore the western coast northward, as far as latitude 48°, *i.e.*, north of the mouth of the Columbia River.

Having landed, he named the country New Albion, and took possession of it in the name of Queen Elizabeth; this was in 1578. The object of his exploration was to find a passage to the north Atlantic.

For the next 150 years no discoveries of importance were made on the west coast of North America.

Hitherto all discoveries in America, both on the east and west coasts, had been made by expeditions crossing the Atlantic westward, but in 1741 Vitus Bering, the intrepid Russian explorer, discovered the continent in latitude 58°, by sailing eastward from Kamtchatka. That part of the continent where Bering landed is now known as Alaska,—the subject of our discourse.

The principal motive of all the expeditions up to this time was not for the increase of geographical knowledge, but for material wealth; legitimately obtained we call it commerce, otherwise conquest.

The Spanish, after Columbus, set out to discover and obtain the silver of Mexico and Peru; and Sir Francis Drake, to discover the Spanish galleons—and he found them. The Russians were after fur, and geography was benefitted by the discovery of the Aleutian and Kurile Islands, the north-west coast and Bering Strait.

The next explorer of note on this part of the continent was the celebrated navigator, James Cook. As a navigator the merits of Captain

Cook are of the highest order. He made many discoveries in the South Sea, and added greatly to Britain's possessions. In 1778, after leaving the Sandwich Islands, which he discovered, he reached the west coast of the continent, which he followed northward in the hope of finding a passage to the Atlantic. He penetrated as far as the bay now known as Cook's Inlet in Alaska, but of course failed in the object of his search. At Bering Strait he was repelled by the impenetrable wall of ice. Returning to the Sandwich Islands to winter there, he met a sad death at the hands of the natives.

We now come to the last and most important explorer, from a geographical point of view, that laboured along the north-west coast of the continent,—George Vancouver.

As an accurate geographer I place Vancouver above anyone previous or subsequent to his time, considering the extent of coast and shore-line covered; and the time taken for executing the same. It is now a hundred years since Vancouver made his survey ; look at the most recent charts extending from California to Cook's Inlet—1,500 miles in latitude—and thousands of miles of coast-line, and what do we find new—minor details—the groundwork is as prominent to-day as a century ago. To one familiar with Vancouver's work and the intricate British Columbian and Alaskan coast, the former must ever be an object of the highest admiration.

Vancouver was with Captain Cook when the latter visited the American continent. After Cook's death Vancouver was given the command of an expedition to the north-west coast of America, the object being to take over from the Spaniards their territory in that region, and to explore the coast from 30° north latitude to Cook's Inlet with a view to the discovery of an eastward passage to the Great Lakes in the British dominions.

Vancouver was then only 33 years of age. He spent the seasons of 1792, 1793 and 1794 in surveying the coast, wintering in the Sandwich Islands. He died when he was but forty, and before he had quite finished the narrative of his work. His zeal led him to take an active share in all operations, and the hardships he thus suffered tended, no doubt, to shorten his life. He was a man of great tact, humanity, generosity, and uprightness of character.

The man who finally established the Russian Empire on the North American continent was the iron-willed Baranov, and the extension of the Muscovite's dominions was due to the value of the fur trade,—sea otters and seals.

In 1797, the various trading companies of Eastern Siberia and the American colonies were consolidated with the Russian-American Company, which, in 1799, obtained a charter from the Imperial Government, granting it exclusive rights in the new Russian possessions. This charter marks an epoch in the history of Alaska, which from that time until the transfer of the country to the United States became identical with that of the Russian American Company.

In 1811, the Russians established themselves on the coast of California, the object being to prosecute agriculture and thereby make California the source of supply for provisions, but in this respect the enterprise proved a failure; for the Siberians and Aleuts, who were placed there, were but very indifferent farmers. Between the Stikine and Bodega Bay in California the Russians never had an establishment.

In 1774-75 the Spanish navigators, Perez and Quadra, made some explorations on the west coast, and later Captains Meares, Portlock and Dixon.

We will now turn our attention to the physical features of the country. The word Alaska, or Aliaska, was first applied to the narrow peninsula of the north-western most part of the North American continent, and extending into the Pacific to where the chain of the Aleutian islands begins. Now, the word Alaska is used to designate the vast territory lying between the Arctic and the Pacific and west of the 141st meridian, together with a narrow strip along the coast extending southward to Portland Canal, and including the adjacent and Aleutian islands. The coast of Alaska, washed by the Pacific, sweeps northward and westward from Dixon Entrance in a mighty curve, measuring over 1,200 miles, to the western extremity of the Alaskan peninsula; and from here again the Aleutian chain of islands stretches, far towards the coast of Asia, in another long curve of nearly 1,000 miles. The most southerly part of the latter curve is in latitude 51° 30', that is, about the latitude of London, England. The most northerly part of Alaska is at Point

Barrow in the Arctic Ocean. The area of land comprised within the limits of Alaska has been estimated at 531,000 square miles, one-sixth of the total area of the United States.

The south-eastern part of Alaska, the narrow strip already mentioned, and which at the present time most interests us on account of its undefined boundary, is shielded from the open sea by a vast archipelago of islands, large and small, 1,100 in round numbers, most of these being mountainous throughout, and all covered with a dense growth of spruce, hemlock and cedar.

The islands vary in size from 125 miles in length to mere definitions. Beside the channels, straits, bays, inlets and canals found here, the fiords of Norway and scheres of Finland sink into insignificance.

As we proceed northwesterly along the coast, the mountains increase in height culminating in the lofty St. Elias on or near the international boundary. His foot is laved by the Pacific, while his snowy head is wrapped in clouds. Mont Blanc, the giant of European mountains, would need a pedestal 3,000 feet high to bring it to the height of our international landmark.

The highly mountainous character of the coast line continues to the extremity of the Alaskan peninsula.

On rounding the peninsula and following the shore line, a total change of the aspect of the coast can be observed. Low, sandy reaches and slightly elevated moorland cover the wide interval between the mountains and the shores of Bering Sea. Similar it is along the Arctic Ocean with occasional rocky spurs and steep cliffs.

The great highway of the interior of Alaska is the Yukon, one of the large rivers of the world. In some parts of its course, through the tundra regions, it is several miles in width. Its vast unsurveyed deltoid mouth makes navigation, with anything but light-draught vessels, impossible.

The length of coast line of Alaska's mainland and islands is nearly four times that of all other parts of the United States combined, being over 26,000 miles, while that of the rest of the United States, from Maine to California, is only about 7,000 miles.

The climate of the Alaskan coast regions is much milder, even in

the higher latitudes, than it is in the interior, or in corresponding latitudes on the Atlantic coast; this is easily explained and understood when the natural forces productive of this milder temperature are contemplated. The most important among them is a thermal current resembling the Gulf Stream in the Atlantic. This current, known as the Japanese or Kuro Siwo, has its origin under the equator near the Molucca and Philippine Islands, passes northward along the coast of Japan, and crosses the Pacific to the southward of the Aleutian Islands, after throwing a branch through Bering Sea, in the direction of Bering Straits. The main current strikes the Queen Charlotte Islands, where it divides, one branch going south along the coast of British Columbia, while the other turns northward towards Sitka, and thence westward to the Kadiak and Shumagin islands. The comparatively warm waters of these currents affect the temperature of the superjacent atmosphere, which, absorbing the latent heat, carries it to the coast with all its mollifying effects. Thus the oceanic and atmospheric currents combine in mitigating the coast climate of Alaska, and the process is greatly aided by the configuration of the extreme north-western shores of the continent, backed as they are with an almost impenetrable barrier of lofty mountains, which holds back from the interior the warm, moist, atmospheric currents coming in from the ocean, deflecting at the same time the ice-laden northern gales coming from the interior.

The force of these influences as mitigating the coast climate of Alaska becomes evident, when it is stated that the mean winter temperature of Sitka is nine degrees higher than that of Halifax, although Halifax is nearly 900 miles further south than Sitka.

It is obvious that with the presence of these warm, moist, currents, precipitation must be great, and so it is. The greatest rainfall on the continent of America is found on its north-west coast. The maximum recorded annual precipitation is 134 inches, or a little over eleven feet. Here in Ottawa we have about three feet, and think ourselves fairly well supplied at that.

It is not alone the excessive rain that makes the coast of Alaska somewhat undesirable as a place of abode, but the rain that does not come down, the mist and fog. The number of days in a year on which

rain has fallen at Sitka has reached as high as 264. No wonder that some of those who have been in Alaska believe that at man's creation a web-foot was forgotten.

Across the mountains in the interior, both of Alaska and British Columbia, the precipitation is very much less, and the range of temperature very much greater.

On account of the mild climate the snowfall on the coast is not great,—less than we have here.

Among other meteorological phenomena to be noted is the wind. In most localities and regions it is a simple matter to tell in which direction the wind is blowing, but not so on the Alaskan coast. It is something like trying to tell which way water is running in an eddy or whirlpool. Out in the broad ocean the wind has undoubtedly a constant direction, for the time being, but when it approaches the coast, passing through long narrow channels, over mountains, down mountains, around some headland or promontory, buffeted from side to side, its direction is difficult to determine, for in a trice it changes. The severest winds in the summer are the 'south-easters.'

Based upon theory and confirmed by experience, the barometer is, par excellence, the instrument for foretelling the weather, but we must draw the line at Alaska. Everywhere else we pin our faith to the barometer, but here the barometer is impotent ; it does nothing to aid, and everything to confuse and distress the sailor and surveyor.

The safest prediction to make is, that it will rain to-morrow, and nine times out of ten you'll be about right.

How one does enjoy a day when the sun shines ! The joy is emphasized by the privation.

It is said that the greatest volcanic region in the world lies in the north-west part of the United States, occupying a large tract in Idaho, Washington, Oregon and California. The last eruption in this region is said to have been that of Mount Baker near the British Columbia boundary in 1870. However, Alaska has still several active volcanoes, but none on the mainland, they are in the eastern Aleutian islands.

One of the most notable features of the Alaskan coast is the glaciers. Whenever the annual snowfall on mountains is greatly in excess of

evaporation and of degelation, glaciers must necessarily be formed. Before the glacier is born, we have immense snow-fields or nevés. Through accumulation the snow becomes compressed, and this process continues until ice is formed. Ordinarily speaking, ice is a solid, but in reality it is not ; in fact, an absolute solid is unknown upon the earth. The behaviour of the ice is like that of a semi-plastic body. When by motion the limit of elasticity in ice is reached and fracture occurs, regelation in a great measure preserves the continuity of the mass. Under the action of gravity and lying on the mountain sides or in depressions, the ice mass flows, and in the same sense as water flows, only of course very much slower. In a river we find the greatest current near the middle, so it is with a glacier. As different rivers have different velocities, depending upon the degree of slope, similarly do we find the rate of flow in glaciers to differ widely, and for like reasons.

Of the living glaciers of south-eastern Alaska, the Muir is the largest and offers probably the best opportunity for measuring the rate of flow. This glacier has an ice front of nearly two miles discharging into the ocean. Its vertical ice-wall at the sea is over 200 feet in height, and its area, including the nevé and its ramifications, is approximately one thousand square miles, or greater than the whole of the renowned Swiss glaciers combined.

By the pursuit of the study of astronomy one is led to contemplate the utter material insignificance of man and his terrestrial domicile in the grand macrocosm,—and when one stands on this vast glacier, hears its thundering echoes as it rends and breaks in its seaward journey, as it grinds and scrapes the underlying rocks, as it changes mountains into moraines, which in time become land,—then again is he impressed with the insignificance of man's powers when arrayed against the forces of nature ;—then is a new leaf of nature opened to his view, to read its significant characters.

Measurements have been made of the recession of the Muir glacier. From them it appears that within the last few years, its average rate of recession has been nearly a thousand feet per year. The flow or forward motion of the glacier is scarcely appreciable at the sides, but in the centre it is at the rate of about 2,500 feet per year. Prof. Wright

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found it, in the summer at central points and near the front, even as high as 65 feet per day. I have stated that the vertical ice wall where the glacier discharges into the sea, is 200 feet above the water, but this is by no means the total thickness of the glacier there. Soundings in the immediate front of the glacier have shown a depth of over seven hundred feet, and, as this is not enough to float a mass of ice rising as high above the water as the Muir glacier, we are forced to conclude that the ice front has a thickness of over nine hundred feet.

A wall of ice nine hundred feet high and nearly two miles long, breasting the element from which it sprang ! We are struck with awe. But stop ! Let us read more of history—written in characters more indelible than those of man. About fifteen miles south of the present front of the glacier, is Willoughby Island of pure rock, and over a thousand feet high, without the slightest vegetation, and showing a strongly striated surface due to glacial action. That this island was covered by this glacier within recent times is obvious to anyone who has visited the bay and noted the surrounding circumstances.

We have the record of Vancouver too, who, a century ago, passed the mouth of the bay, and reported it one mass of ice.

Hence, had we measured the thickness of the ice only a century ago, where the present ice front is, we should have found it at least 4,000 feet thick instead of 900 as at present. What stupendous change ! and all almost within the space of a life. This evidence goes to show that the Muir glacier was at one time, and not long ago, much larger than it now is ; but there is evidence too, that it has been much smaller, for on the west side we find a buried forest. Standing trees in situ are found there, which undoubtedly are incontrovertible evidence of a former and greater diminution of the glacier than the present shows.

To give another illustration of the rapid recession of the glaciers at present and during the past, I will quote Sir George Simpson, Governor of the Hudson's Bay Company, who, in 1841, paid a visit to Alaska. When going up Frederick Sound and Stephen's Passage he says :— "The valleys were lined with glaciers down to the water's edge, and the pieces that had broken off during the season filled the canals and straits with fields and masses of ice, through which the vessel could scarcely force her way.

The land on either side displayed to us mountains rising abruptly from the sea, and bearing a glacier in their every ravine. Earlier in the season, these glaciers would have been concealed by the snow, but now they showed a surface of green ice."

The district referred to by Simpson, I frequently visited during the past season, and along Simpson's route there is now not a single glacier reaching tide water. Many of the glaciers of which he speaks have entirely disappeared, and others show their terminals 2,000 feet and upwards from the sea. These are vast changes to occur in a lifetime. There are, however, still four living or tide-water glaciers outside of the great Muir glacier, which discharge ice and small bergs into the sea. Glacier ice differs vastly from Arctic or sea ice. The colour of the former on a face of fresh cleavage is transparent blue of transcendent beauty, impossible to describe. It is very hard and not brittle, and in the sea slowly wastes away. It is dangerous for a vessel to run into glacier ice. Sea water ice is, on the other hand, brittle, and readily crumbles under compact, and is subject to very rapid decomposition. To illustrate the latter, Prof. Elliott mentions that on the 27th of May, 1873, the ice fields still surrounded the island of St. Paul in an unbroken mass, as they had done for the preceding five months. The following morning nearly the whole mass had disappeared. As he says, "the decomposition of the ice had taken place so secretly that its final relegation to its original form was fairly accomplished almost instantly and simultaneously, and without warning to human eye; the alternate layering of salt, in ocean water ice, accounts for this peculiar vanishing of sea floes."

That the discharge of glaciers must to some extent affect the temperature of the neighbouring sea, is obvious. During the past season I took a series of temperature readings of the sea as well as of the atmosphere. The mean temperature of the sea along the coast was found to be about 49° F., while the coldest part was found in Endicott Arm, into which the Dawe's glacier discharges,—there the water registered 36° F., a temperature of water in which a misfortune with a boat or canoe would be equivalent to certain death. A marked difference is found even at the same place. The difference is produced

by the tides. When the tide is flooding we have the broad waters of the Pacific rolling towards the coast; but at ebb tide the cold glacier waters from the shore run out and on the top, being lighter, and hence we find a diminution in temperature of about seven degrees F. From the observations it would appear that the mean summer temperature of the ocean outside of the immediate coast of south-eastern Alaska is about 54° F., which is that of the atmosphere too.

The resources of Alaska are—in order of value,—furs, fish, minerals and timber.

Among furs the seal fur stands vastly pre-eminent.

Our first knowledge of the seal dates back some two hundred years, when in 1684 William Dampier, the privateer, in his voyage round the world, visited the island of Juan Fernandez, of Robinson Crusoe fame, in the South Pacific, and there saw thousands upon thousands of the fur seal.

It appears, however, that a hundred years elapsed ere the fur became a prized article of commerce. Amongst other places in the South Sea in which formerly the fur seal abounded, may be mentioned Masafuera, the South Shetland, Falkland and Georgian islands.

Greed, improvidence and indiscriminate slaughter of old and young, male and female, in a comparatively few years brought about the inevitable, almost annihilation of the seal herds in the South Pacific. In two short years, 1821 and 1822, 320,000 seals were taken from the South Shetland islands alone. They killed all and spared none. The Falkland islands were the rendezvous of a large sealing fleet for a period of nearly thirty years,—1800 to 1826 inclusive, and during this period the whole Antarctic sealing ground was ravaged by the fur-sealers.

While British and American sealers were scouring the South Seas, the seal industry began to gain an importance in quite another quarter of the globe—the Pribilov islands in Alaska. Let us dwell for a moment on the history of the discovery of these valuable islands. The Russians, in their search for fur and new fields, reached the shores of Kamtchatka at the close of the seventeenth century, and there, for the first time, beheld the beautiful and costly fur of the sea-otter. The animal bearing this pelage then abounded on the coast, but by the

middle of the eighteenth century had been almost extirpated therefrom. However, the discovery of Bering island and the Aleutian chain furnished fresh fields for the capture of this valuable animal. But alas, the ravages of man were greater than nature's production, and towards the latter part of the last century the sea-otter gatherers found their occupation almost gone, and hence were obliged to turn their attention in another direction. Up to this time the fur seal, although noted, had not been much valued. Now, however, the Russians became interested in this animal. It had long been noticed by them as well as by the natives that the seal proceeded north through the chain of the Aleutian islands in the early summer and south again in the fall. Where they spent the summer and where they bred, was a profound mystery. It was only after eighteen years of unremitting search by hardy navigators that the El Dorado, the fog-bound Pribilov islands, was found, and by the man after whom the islands are named. This was in 1786. The difficulty of finding this place does not now seem strange, when we understand the currents, the winds and fogs of these waters. The Pribilov islands,—St. George and St. Paul,—lie in the heart of Bering Sea, and are among the most insignificant landmarks known in that ocean, and being almost incessantly surrounded by fog, afforded the fur seal the happiest shelter and isolation. During the year immediately succeeding the discovery of the islands, over 500,000 fur-seals were killed by the Russian hunters. It was obvious that such indiscriminate slaughtering could not continue indefinitely, and government control became necessary. As already stated, the outcome was the formation of the Russian-American Company in 1797, which held absolute sway in Alaska, practically until the cession of the territory to the United States in 1867.

The impetus to the seal-fur trade was given by the Chinese, who were the principal customers of the Russians. Kiachta, a town in the interior and on the Chinese frontier, was the great centre of trade between China and Russia, and thither the furs made a two-thousand-mile overland journey to be exchanged for teas and silks, principally the former. The Chinese prized this fur very highly and they were the first to discover the art of dyeing it.

Three years after the cession of Alaska, the Alaska Commercial Company obtained a twenty-year lease of the Pribilov islands, the consideration being an annual rental of $55,000 and besides a revenue tax of two dollars on every skin taken. The maximum number of seal skins allowed to be shipped was 100,000 per annum. As the original cost or purchase price of Alaska was $7,200,000, it is seen that the United States had almost from the beginning an income from these two small islands alone of nearly four per cent. on their investment for the whole territory.

A few words about the seal itself. Professor Elliott, of the Smithsonian Institution, spent several years on the dismal Pribilov islands for the express purpose of thoroughly studying seal life in all its phases, and to him most of our accurate knowledge of seal life is due. As already stated the first seal-fur of commerce came from the South Sea, hence the name South Sea seal still obtains, although by far the greater number of skins now come from the Alaskan or North Pacific waters. Whether ever the Alaskan seals migrated from the South Sea, thereby crossing the equator is not known, neither was it certainly known where these animals spent the winter months till this was discovered in the course of the investigations of the British Bering Sea Commission in 1891, when it was ascertained that the greater part of this season was passed in the waters adjacent to British Columbia and Southern Alaska. Prof. Elliott says, "there are few, if any, creatures in the animal kingdom that can be said to exhibit a higher order of instinct, approaching even our intelligence" than the fur seal.

A male in its prime, say six or seven years old, will measure 6½ to 7¼ feet from the tip of its nose to the end of its abbreviated, abortive tail, and will weigh at least 400 pounds. The female on the other hand is very much smaller, being from 4 to 4½ feet long, and is only about one-sixth of the weight of the male, but is much more shapely in its proportions. The adult males are the first to arrive in the spring, between the 1st and 5th of May, on the seal grounds or rookeries on the Pribilov Islands. It may be remarked also here that after the adult males land, they never leave the island nor partake of any food whatsoever until they leave some months later in the fall to spend the winter

in more southern waters. When they arrive in spring, they are rolling in fat, and when they leave in the fall they are a bundle of skin and bones. As soon as they arrive on the breeding grounds, each one, according to his physical persuasive power, pre-empts a certain area, and remains there, awaiting the arrival of his spouses, for the seal is polygamous. Many of these adult males or bulls exhibit wonderful strength and desperate courage. Prof. Elliott marked one veteran, "who had fought forty or fifty desperate battles and fought off his assailants, who coveted his position, every time. When the fighting season was over, the veteran was covered with scars and frightfully gashed; raw, festering and bloody, one eye gouged out, but lording it bravely over his harem of fifteen or twenty females, who were all huddled together on the same spot of his first location and around him." Between the 12th and 14th of June the first of the cow seals arrive at the islands. The arrival of the cows is co-incident with the ending of the period of gestation, for one or two days after arrival the pup is born. The young are nourished by the mother, who frequently goes out to the sea to feed and bathe. The pups do not essay to swim, which they must first learn, like any boy, until they are a month or more old. The head and eyes of the female are exceedingly beautiful; the large, lustrous, blue-black eyes are humid and soft, with tenderest expression. The covering to the body of the fur-seal is composed of two coats, one having a short, crisp, glistening over-hair; and the other a close, soft, elastic pelage or fur, which gives the distinctive value to the pelt. When the skin reaches the furrier the hair has been removed and the pelage dyed.

Two-thirds of all the males which are born, and they are equal in number to the females, are never permitted by the remaining third, strongest by natural selection, to land upon the breeding ground, but this great band of "bachelor" seals, as they are aptly termed, is obliged to live apart entirely, sometimes miles away from the rookeries. In this admirably perfect method of nature are these seals, which can be properly killed without injury to the rookeries, selected and held aside, so that they can be taken without disturbing in the slightest degree the entire quiet of the breeding grounds where the stock is perpetuated. Such was, according to Prof. Elliott, the state of the rookeries in 1872-74, but

when he revisited the islands in 1890 he found that a great change had occurred. The "bachelors" no longer lay out in areas distinct from the breeding grounds, but in reduced numbers sought the protection afforded by the vicinity of the breeding grounds, so that it was no longer possible to drive the non-breeding seals without disturbance to the breeding rookeries. This great change he attributes to over-driving and over-killing of seals upon the islands and to the operations of pelagic sealers, acting concurrently. The relative importance of these causes of undoubted decline in numbers, on the Pribilov islands at least, have been earnestly discussed in connection with the Bering Sea arbitration.

When driven inland for a short distance by the natives, the seals find themselves upon the killing grounds.

Care must be taken not to urge them above half a mile an hour for overheating of the seal is very detrimental to the fur. The fur is thickest and finest in texture during the third and fourth year of life. Having arrived at the slaughtering grounds, and after the seals have cooled off, the killing begins. A hundred to a hundred and fifty are separated from the herd and on a given signal the natives, armed with oaken bludgeons five to six feet long, rapidly club and kill the unfortunate animals. They are then immediately bled and skinned. The whole work is performed in a remarkably short time. The average time taken to skin a seal is only four minutes, while the best men can do it even in a minute and a half. The skins are taken from the field to the salt house, where salt is profusely spread on the flesh-side, and they are piled up in the "kenches" or bins. After two or three weeks they become pickled and ready for shipment. Most of the skins go to London, England, for dressing and dyeing. The number of seals, male, female and young, annually visiting these islands has, from careful estimates, been found to exceed four millions.

By the middle of September the rookeries are all broken up; by the end of October, or the beginning of November all the fur-seals of mature age have left the islands. During August they shed their coats.

As practically only prime skins are taken at the islands, the great variation in seal-skin sacques is due mostly to the quality of work whereby the fur was treated and prepared for wear. A properly dyed skin,

one that has been conscientiously and laboriously finished,—for it is a labour requiring great patience and skill,—will not rub off nor "crock" the whitest linen when moistened; and it will wear the weather for six or seven seasons without showing the least bit of dimness or raggedness. The unhairing, in which the over-hair is deftly combed out and off from the skin, is done by heating the skin to a certain point so that the roots of the fur are not loosened, while those of the coarser hirsute growth are. If this is not done with perfect uniformity, the fur will never lie smooth, no matter how skilfully dyed; it will always have a rumpled, ruffled look. In dyeing, the liquid dye is put on with a brush and the skins hung up and dried. The dry dye is then removed, and so on until eight to twelve coats have been applied to produce a good colour. The skins are then washed clean, the fur dried, while the pelt is moist.

The fur-seal is a voracious eater. Its food is fish to the practical exclusion of all other diet. Cod, herring and salmon must lay tribute to its insatiable appetite, and the great North Pacific, 5,000 miles across, between Japan and the Strait of Fuca is its fishing pond. A low estimate of the annual consumption of fish by seals visiting the Pribilov islands, gives the enormous quantity of six million tons. As Prof. Elliott says: "The fishing of man, both aboriginal and civilized, in the past, present, and prospective, has never been, is not, nor will it be, more than a drop in the bucket contrasted with the piscatorial labour of these ichthyophagi in those waters adjacent to their birth."

The most valuable of all furs is that of the sea-otter, which, however, is becoming year by year scarcer. Its haunts formerly extended along the whole coast of Alaska and further south, but the animal is now seldom met with. A prime skin is worth upwards of $300.

Of land furs may be mentioned the land-otter, the brown and black bears, the beaver, the red, the black, the silver and the Arctic fox, and the mink and martin. The red fox is the most widely distributed fur bearing animal in Alaska. In south-eastern Alaska the principal fur obtained is the black bear. For hunting, the Indians are provided with rifles, and they have generally a very exalted idea of the value of their game. It is not an uncommon thing for an Indian, after not receiving the price demanded at Juneau, to start off with his canoe for Port

Simpson, or even for Seattle,—one thousand miles distant on the ocean,—to sell his skins. An Indian whom I know, went in his canoe last year to Seattle and there sold his bear skins, some forty odd, and returned with $1,400 in cash. Of the Indian character I will speak further on.

Next in value to the fur trade of Alaska stands the salmon industry which has been developed to an astonishing degree during the last decade.

The annual pack now is about 700,000 cases—nearly $3,000,000 in value. Nearly the half of the output comes from the Karluk River on Kadiak island. This stream is not over fifty feet wide and not long, yet a dozen canneries draw their supply therefrom. Some years the run of salmon is much greater than usual. During the past season salmon were very plentiful. About the beginning of June they commence coming in from the ocean to ascend the streams for spawning. As the summer advances their number increases; up every river and stream, rivulet and rill, instinct drives them to fulfil their mission. Many succeed, but hundreds of thousands, nay millions, perish miserably at the mouths of torrential streams or cascades, attracted thither by the fresh water. They are pursued and attacked by the dog-fish, a species of shark, and one often sees salmon swimming about with pieces bitten out of their sides; and again towards fall thousands are found blind, hopelessly swimming about the mouth of their gaol. It is a pitiful sight. Their race is run. High tide piles them on the beach to rot. For miles the air becomes offensive beyond endurance, and more than once was I obliged to change our proposed anchorage on account of the shoals of dead salmon. In south-eastern Alaska all salmon are packed by Chinese who are imported for the season from Portland or San Francisco.

Next to the salmon the codfish stands foremost in quantity as well as in commercial importance. However, as the demand is limited, the development of the cod-fisheries is very limited, the annual catch being only about $40,000. The fish next in importance is the halibut, which is found in great numbers in favoured localities in south-eastern Alaska. It and the salmon form the great staple for consumption by the natives.

There is very little halibut exported. We caught, one day, with two hooks and in less than an hour, over half a ton of halibut. It is a delicious article of food and its most toothsome part is the dorsal fin.

To the Indians the Oolachan or candle fish is of considerable importance. It is a small fish and very oily, in fact so oily, that when dry it will burn like a taper or candle, hence the name candle-fish. The oil obtained from it is used by the coast Indians as an article of trade with the interior Indians, who are very fond of it.

Numerous whales may always be seen sporting and spouting in Frederick Sound, but are unmolested by natives and whites.

The Killer Whale (*Orca ater*) is frequently seen too, and it is a sight to see a huge whale when pursued rise vertically out of the water forty feet and then strike with terrific force, splashing the water with volcanic effect.

Immense shoals of herrings visit some of the bays. However, there is only one establishment—Killisnoo—where herring are caught for commercial purposes. All the herring caught there are converted into oil, and the residue is pressed, roasted and ground and sent to the sugar plantations on the Sandwich Islands as a fertilizer. At Killisnoo, the wharf, the walks and the factory are ever wet and saturated with fish oil, and the newcomer is very apt to perform some involuntary acrobatic feats. The Indians are very fond of herring spawn. To obtain it small branches of evergreen are placed in the sea at low tide, and with the rising tide the branches become thickly covered with roe. The twigs then look as if they had been sugared. The Indians eat it right from the branches.

Next in importance to the fisheries is the mining industry. However, when one examines the cold facts about mining in Alaska, the result is not very cheering. Leaving out the Treadwell mine, on Douglas island, near Juneau, it is safe to say that more value in labour has been expended in obtaining gold than all the gold that has been sent out of Alaska, be it from placer or quartz mining, is worth.

The Treadwell mine yields a very low grade ore, but it is very easily mined or quarried, being an open mine, and there is almost an inexhaustible quantity of ore there. The company has a 240 stamp mill for

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crushing the ore, and chlorination works for extracting by chemical process the finely disseminated ore. The fumes from the chlorination works have killed the surrounding forest over a large area.

The annual output from this mine is about $800,000, of which a little over half is profit.

On several mines back of Juneau, in the Silver Bow Basin, several hundred thousand dollars have been expended in extensive hydraulic mining, but so far the net results have not been very remunerative. Prospectors' holes, and small tunnels, are quite numerous along the coast. Each in turn had its day of showing the "best indications" and then dropped out of sight.

Mining, or rather prospecting, is undoubtedly an alluring vocation. The prospector lives and starves on hope, striking it rich some day; yet, how very small is the probability of his success and how great the sacrifice he makes.

The discovery of rich gold and silver mines or diggings is not an unmixed good. The value of these mineral finds, although sometimes very rich, is generally ephemeral. The result is an abnormal prosperity of one or more towns or cities whose birth is due to the gold or silver discovery. Railroads are built, business, bustle and activity are rampant in the mining region. After a few short years, the scene changes, mines or diggings are exhausted, there is a stampede out of the district almost as vehement as there was into it. Real estate, houses, blocks, everything immovable becomes unsaleable. Many of the people of the mining region have been ruined through its shortlived prosperity. A glaring example of these conditions is the state of Nevada, which some years ago was struck by a rich mineral wave, on the crest of which Nevada was enabled to ride into full sisterhood in the Union. To-day it lies prostrate, and her whole population, spread over an area of 110,000 square miles, is less than that of the city of Ottawa. In the same relation I might mention the Fraser River and Cariboo gold diggings in the sixties. Where are to-day the signs of prosperity of those golden footsteps of years gone by? What I wish to impress is, that a country that is solely or mainly dependent on gold or silver production is a factor in unstable equilibrium. Gold and silver mining is not conducive to the permanent

settlement of a country. The great gainers by such mining regions are the outside centres of supply, whose creation is not due to the discovery of minerals, and whose permanence is dependent on other sources of business.

A far more valuable mineral than gold or silver, is coal. Although coal has been found at several points in Alaska, yet up to the present it has not been mined for commercial purposes. That country has the greatest stability whose principal resources are food, hence the ultimate and inevitable success of Manitoba and the North-west.

To sum up, the mineral resources of Alaska thus far developed are gold mines, and of these the Treadwell mine produces nearly the whole annual yield.

We now come to the last of the natural resources of Alaska, viz: timber. The public is apt to associate with the word Alaska a cold, barren, rocky country. But such is not the case, especially not in south-eastern Alaska, where, on account of the mild temperature and copious rains, a luxuriant vegetation is seen on the strip bordering the sea. Heavy carpets and festoons of beautiful mosses, luxuriant ferns and dense undergrowth, characterize the coast region. The whole area is densely wooded. The timber line is found at an elevation of about 2,500 feet. Spruce and hemlock are the predominant varieties of wood; red and yellow cedar are also found, but in limited quantities. On deltas and sea level terminal moraines, the poplar and cottonwood are found. The alder flourishes on old moraines and on snow slides, and the crab apple is sparingly scattered through the forest.

Although the country is densely wooded, yet the timber fit for the mill is very limited, and hence no very great value attaches to it. For some, not very apparent, reason, the United States government prohibits the manufacture of lumber in Alaska for export, even into the United States. There are a number of small saw-mills in the country, which supply the limited demand for building purposes and for the shooks used by the canneries for salmon cases or boxes. The spruce grows to a very respectable size. I have measured some logs over five feet in diameter; however, the average is under three feet. Soil there is not much, and it is astonishing on how little the trees grow. How-

ever, the nourishment is apparently not equal to the demand, for after the trees have attained a certain height the tops die, and looking over the forest from the sea it presents the appearance of hop poles.

The lumbering is all done on the immediate coast, and the logs rolled or skidded into the sea, and then boomed and drawn by tugs to the mill.

The population of Alaska by the last census, that of 1890, gives a total of 32,000, of whom 4,300 are whites, 23,500 Indians and 2,400 Mongolians and others. There are less than 500 white women in the whole country, at which fact I think a philanthropist would rejoice.

The natives of south-eastern Alaska, with whom we are immediately concerned, belong nearly all to the great Thlinket tribe.

Everywhere in nature science is gathering facts. Facts are correlated, and cause and effect studied. Under the term cause is included the term environment. Environment plays a great part in both the animal and vegetable kingdoms. It is the key that has unlocked many of the secrets of nature, and in skilful hands will further shed light on nature's work. Thus has environment exerted its influence on the Indians in moulding their habits, customs and character, and also, to some extent, their physical traits. The island home of the Haidas in the broad expanse of the Pacific has developed them into the highest type of Indians on the coast. The Thlinket have, in general, thick, coarse, straight, black hair, large fiery eyes, a small, flat, broad nose, and large cheek-bones. As much of their lives is spent in canoes, it has impaired their powers of locomotion, and misshaped their legs, rendering them decidedly awkward on shore. Their teeth are white, but in old age become worn down by eating dried salmon on which sand and grit have gathered in the process of drying. Many of the females, in their youth, are quite rosy and comely. In complexion both sexes are surprisingly light coloured, which is not due to any admixture with whites, although admixture is not uncommon. It is recorded that formerly they bathed frequently, both in summer and winter, and thereby hardened their physique ; furthermore that the children were daily bathed in the ocean ; this undoubtedly resulted in the survival of the fittest. From my observations, however, I think that

this habit has gone out of vogue, judging from the faces of many of the children and grown up people as well.

The greatest curse to the Indian has been alcohol, and against this temptation he seems absolutely unable to struggle. Small-pox has ravaged the coast terribly. Rheumatism and pulmonary diseases are their worst ills, while venereal diseases are extremely destructive.

Year by year it is becoming more difficult to study the Indian, as with the increase of travel and commerce, and consequent contact with whites, he is steadily losing his native characteristics and adopting instead our customs and habits. They are reserved and taciturn and show an utter indifference, in fact contempt, towards the whites when by chance they meet on a common camping ground. This latter characteric is different from that of our North-West Indians, who are also taciturn, but very inquisitive to see what is to be seen. They are not as fond of display and parade as formerly ; however, on the 4th of July, a day they anxiously look forward to, many of them are clothed with all the fineries, not Indian, but the best to be had in the stores. Last 4th of July I happened to be at Juneau, where hundreds of Indians had gathered to attend and take part in the festivities. To one accustomed to seeing concourses of Indians in the Northwest it was a sight to study. Many of the young Indian women were dressed in silk, or satin, or velvet ; in white, red, blue, yellow or black : the hair "banged" and crowned by a nobby hat : the face powdered à la mode ; the feet encased in buttoned kid boots, and perfume and jewelry galore. The older ones content themselves with wool or cotton fabrics ; only one squaw did I see with the time-honoured blanket. The young men were similarly well dressed, wearing nice store clothes, silk-trimmed spring overcoats and watches, and smoking cigars. The whole illustrated what has been abundantly proved, and that is, that commerce is the great civilizer of native races.

Dancing and singing were formerly a part of their ceremonies of welcome, trade and war ; but now the dancing is that of Americans and confined generally to festive gatherings. At the dance or ball given on the above day in the Juneau Opera House, the grace with which some of the Indian ladies waltzed was very marked. By nature the Indian

is rather indolent, but his ambition for wealth and its inherent mark of distinction makes him enterprising. They have considerable business judgment, and it is a rare occurrence that a white man gets the better of a bargain with an Indian of south-eastern Alaska. When first visited by the early voyagers, these Indians, like all others on the coast, were bold, arrant thieves; to-day, however, this accusation cannot be made against them. They have great respect for the aged; between the sexes the rights of the women are regarded, and they live on terms of equality. They have considerable artistic taste in the use of colours, are advanced in the arts of carving in wood, slate and metal, and have fair abilities in drawing and designing. In the latter I found a marked characteristic, and that is, the absence, or scarcity at least, of curves in their designs, they being nearly all angular and rectangular.

The totem poles one finds in the villages throughout south-eastern Alaska are relics of the past. They are carved tree trunks, upwards of thirty feet high, with grotesque figures which, in a measure, represent a genealogical tree. A totem is simply an organization of consanguineal kindred into a recognized group or band. The organization is based on mother-right, (such as rank, wealth, property etc.) received from the mother. The most prominent totems met with are the wolf, raven, eagle, bear and whale.

The practice of mutilation is older than recorded history. Man never has been satisfied with either his structure or appearance, and has constantly endeavored to improve upon both. However, at present little mutilation is done. Occasionally one meets a woman with a pierced under lip, a projecting plug being inserted into the hole; and also women with tatooed arms and hands. The most hideous practice still in vogue among the women is that of painting the face black, leaving a large circle around the eyes unpainted, thereby making the face most repulsive. The paint consists of fish-oil and charcoal, and acts as a preventive against mosquitoes. Another use is for improving the complexion, and for this purpose it is efficient. I recollect seeing a squaw going off with a blackened face for some weeks on a hunting tour with her husband; after they returned, she washed herself and emerged like a butterfly from the chrysalis, clean, fair and bright.

The canoe is to the North-west coast what the camel is to the desert. It is to the Indian of this region, what the horse is to the Arab. It is the apple of his eye and the object of his solicitous attention and affection. The canoes are hewn out of one solid cedar trunk, and are now seldom made over 30 feet long, although formerly they were made over twice that length and carried several tons. Every year finds the Indians more and more abandoning their old form of one-room houses, earth floor and central fireplace, and adopting our manner of building. In short, the Indian is day by day becoming more of a white man. He is still fond of dogs, ad infinitum one might say, especially when one hears the apparently preconcerted simultaneous howl of the colony. Their food, they mostly find on the tide flats, where the Indian table, too, is set twice a day. The advance of civilization has not robbed the Alaskan Indian of his means of sustenance, as the disappearance of the buffalo has our North-west Indian. Commerce and civilization can never rob the Alaskan Indian of his food. Sepulture as now practiced is mostly by inhumation-at-length. They also buy cheap paper-covered trunks into which the corpse is packed and placed in a small enclosure or house, over which float streamers or flags to ward off the evil spirits. Cremation and aerial deposition are not practiced now. The shamans, or medicine-men, witch-craft, and slavery received their quietus after the United States came into possession of Alaska. Similar it is with the potlach, or grand party as we would call it, which served as in modern society to a great extent to give a social standing. The Indian often gives potlaches beyond his legitimate means; he probably anticipated the white man. At the ceremony of an Indian house-warming at Wrangell it cost the host $5,000 in blankets and other presents.

In conclusion I will speak briefly of the Survey being made in Alaska by our Government.

The definition, by treaty in 1825, of the boundary line of Alaska was the outcome of, and a side issue in the protest of Great Britain against the unwarranted assumption by Russia of exclusive jurisdiction in Behring Sea. The British position was at the time tersely stated by the significant words—" We negotiate about territory to cover the remonstrance upon principle.'

The treaty made the boundary in south-eastern Alaska run along the summit of the mountains situated parallel to the coast, but in no case to extend farther inland than ten marine leagues. Although at the time of the treaty, Vancouver's and other charts existed, showing accurately the shore line and islands, yet of the true topography of the country itself little was known ; in fact, our survey is the first attempt to determine the topography on which by the terms of the treaty the position of the boundary line depends ; hence it will be seen and understood that the joint survey now being made is not to define the boundary line, but to get the topography of the country adjacent to the coast, so that, thereafter, intelligent discussion can take place and ultimate delimitation on the ground be effected.

The system of photo-topography, which was developed by the Surveyor-General, Captain Deville, and so successfully applied in our Rocky Mountains, was adopted by the Canadian Boundary Commission for its work in Alaska, where, on account of the intensely mountainous character of the country it was especially applicable. It may be mentioned with pride that the officers of the United States government who were in the field with us, acknowledged our method far superior to theirs, in fact said that our method was the only practicable one in such a tumultuous region.

Armed with a specially constructed camera and small transit instrument, the surveyor with his assistants climbs the mountain peaks and there makes angular measurements, and takes photographs of the surrounding country within a radius of at least ten miles. It is scarcely necessary to say that his work is intensely laborious, and often dangerous to life ; breaking his way through jungles of dense undergrowth in the primeval forest, fighting that poisonous shrub, the devil's club ; crawling up and around precipices, crossing treacherous glaciers with yawning crevasses and chasms ; standing with wet clothes on a pinnacle in a howling wind and at times in a snow storm : such are a few of the trials and tribulations of the photo-topographer ; but he is happy as long as he gets good views ! However, when, time and again, he has to ascend thousands of feet the same mountain only to find himself enveloped in a fog or clouds at the summit, then !—well, he climbs again.

The alpenstock is an indispensable adjunct for climbing. Inexperienced men invariably consider a gun or rifle very desirable in climbing, "to shoot a bear, don't you know." Suffice it to say, no bears were shot while mountain climbing. The picture presented to one, on one of the summits, is well described by a recent writer thus:

"What a scene of desolation
I saw from the mountain peak,
Crags, snowfields, glaciation
Unutterable to speak."

Scarcely a vestige of verdure is in sight, arctic are the surroundings. What grand upheavals of nature come under the topographer's gaze! Dozens, nay, hundreds of ice-bound and mountain-hemmed lakes come under his view and tell of receding glaciers. He traces from the nevé and melting glacier, rills to creeks, creeks to streams, and streams to rivers, until they enter whence they came, the ocean.

Camping along the Ottawa is considered sport and healthy outdoor exercise; in Alaska with the incessant rains, it is considerably the reverse. Clothes, boots, provisions, everything gets mouldy in camp. The precipitous nature of the shores makes good camping ground very scarce, and an undue regard for the high or spring tides caused some rude awakenings at night, to find oneself unceremoniously a dweller in the Pacific or living in Venice. Nearly all the ascents were made directly from the sea-shore.

The highest mountain climbed was within a few feet of 7,000 feet above the sea. The experienced climber covers about a thousand feet an hour. The descent. when over snow fields, is sometimes made at a dangerous velocity, by squatting down and tobogganing, using the alpenstock for steering. This method is rather risky, for an unseen precipice may some day be the cause of an untimely end to the topographer's career.

Several hot springs were encountered on the work. I took the temperature of a sulphurous one near the coast, and found it to register 164° F., a temperature sufficient to boil eggs. Hot springs and glaciers,—a peculiar combination!

On account of the continued saturated condition of the atmosphere

great care must be exercised with photographic plates, for which reason they are kept in tin boxes, water and air-tight.

During the past season about seven hundred photo-topographic plates were obtained, covering an area of nearly five thousand square miles ; besides nearly a hundred 8 x 10 plates, making a collection of photographs showing glaciers, glaciation, and glacial action of the greatest interest and value.

I will dwell for a moment upon climate, with special reference to an ice age or glacial period. The absolute amount of heat received annually from the sun is not known, nor the fluctuations in the emanations from the sun, nor his rate of cooling ; all of which affect both the meteorological and climatic conditions upon the earth. However, certain it is, that astronomical conditions, periodic in their function, must produce some effect on climate. Climate, and its offspring, meterology, are complex subjects. They are the effects or phenomena of various causes interlinked and interwoven to such a degree that up to the present time their true history has not been written. We know that summer and winter are due to the obliquity of the axis of the earth to the plane of its orbit. By summer we understand the time from the vernal to the autumnal equinox, and winter from the autumnal to the vernal. The proportion of heat received in summer is to that received in winter as 63 is to 37 ; and this is practically constant for all time ; for the obliquity changes but very little.

If there were no other changes in the relative position of the earth towards the sun, there would be no change of climate further than that indicated above ; but, as a matter of fact, the earth, revolving in an elliptic orbit around the sun, does not preserve the same orbit through all times, that is, the eccentricity changes. Furthermore the line of equinoxes passes around the ecliptic, and this, combined with the change of eccentricity of the earth's orbit, produces a change in the climate by changing the lengths of summer and winter.

For instance, at present our summers are seven days longer than our winters, there being 186 days between the vernal and autumnal equinoxes, and 179 between the autumnal and the vernal. The time required for the line of equinoxes to make a complete revolution is, in

round numbers, 21,000 years; so that in 10,500 years (one half of that time) the conditions will be reversed; that is, we shall have a winter of 186 days, and a summer of 179 days. Then we shall have for winter the 37 per cent. of the annual heat spread over 186 days, whereas now it is spread over only 179; and there must be, in consequence, a lowering of temperature, which, when counted from absolute zero or the temperature of intersellar space, must be quite an appreciable quantity, and one not to be neglected. The maximum difference there can be between winter and summer is about 25 days, and this occurs when the orbit of the earth has its greatest eccentricity, and the line of the equinoxes is perpendicular to the major axis of the earth's orbit we have then the maximum astronomic cause for glaciation.

Another important point which must be taken into consideration is this, that the total amount of heat received upon a hemisphere at any time, and in any geologic age, is practically constant, or nearly so.

Now, as the total annual heat is constant, and the ratio of heat received in summer and winter is also constant, but the lengths of winter and summer vary, therefore the average amount of daily heat received in winter and summer during different years varies. This gives us a clue for one of the causes for an ice age.

The condition favourable for glaciation is, naturally, one where the winter is longer than the summer, and whenever that condition obtains in one hemisphere of course the reverse obtains in the opposite one. We can safely say, therefore, that 10,500 years ago the northern hemisphere, if not glaciated, was at all events, disposed towards glaciation, and very likely, in part, was glaciated. From astronomic reasoning, there would be a succession of periods tending towards glaciation, the effect of which other causes may mitigate, or even obliterate, or on the other hand, intensify.

The distribution of land and water, atmospheric and oceanic currents, of course, exert a powerful influence on the conditions brought about through astronomic causes. The preponderance of land in the northern hemisphere may possibly be due to the fact that during the critical time of crust-forming that hemisphere had its winters for thousands of years in aphelion.

It is not my intention to go further into the question of ice ages, but I simply wish to show that the question of ice ages or glacial epochs is one which properly falls also within the sphere of mathematicians and astronomers, and is not one wholly belonging to the realm of the geologist.

(Mr. Klotz then showed, with the aid of a lime-light, 28 typical views of Alaska, taken in connection with the Boundary Survey. Numerous dead and living glaciers were thrown on the screen, showing lateral, median and terminal moraines; also the erosive and grinding action of glaciers. The principal features of each view were lucidly explained.)

The largest glacier in Europe is the Aletsch, which measures about fourteen miles from its nevé to its foot. The celebrated Mer de Glace, which descends from Mont Blanc to the valley of Chamounix, is about eight miles long below the nevé-field. On our survey the nevé of the Foster Glacier was found to extend into the interior thirty miles, and this is by no means the largest one. The glaciers of the Alps are mosty confined to the northern side of the mountains and none of them descend below 4,000 feet.

A feature of a once glaciated area, is the numerous lakes that are left after the recession of the glaciers; partly in basins that have been scooped out, and partly in basins that have been formed by damming of the valley by moraines. Those of the latter kind become relatively soon drained by the erosion of the barrier. In Tyrol, during the past century, no less than one hundred and eighteen lakes have disappeared, as found by comparison of maps covering that period.

Knowing the origin, then, of many lakes in northern latitudes we are not surprised at the innumerable lakes that dot Canada from Halifax to the Mackenzie.

Norway presents a similar picture.

References

"The Seal Islands of Alaska," H. W. Elliott.

"The Coast Indians of Southern Alaska and Northern British Columbia," by A. P. Niblack.

Eleventh Census, 1890, U.S.

MARINE BIOLOGICAL LABORATORY WOODS HOLE LIBRARY

Abstract of Meteorological Observations

	MONTHS.				
	Jan.	Feb.	March.	April.	May.
Average height of barometer at 32° and reduced to sea-level	29.997	30.147	30.067	30.047	29.863
Highest barometer	30.650	30.951	30.611	30.615	30.299
Lowest barometer	29.086	29.300	29.519	29 244	29.267
Monthly and annual ranges	1.564	1 651	1.092	1.371	1.032
Average temperature of the air (Faht.)	3.61	9.82	23.19	36.47	53.33
Difference from average	—7.21	—2.58	+0.29	—1.13	—2.17
Highest temperature	40.2	38.8	45.0	65.2	87.5
Lowest temperature	-26.2	-23.1	—5.2	9.0	33.8
Monthly range	66.4	61.9	50.2	56.2	53.7
Average maximum temperature	11.50	19.21	31.99	46.16	64.53
" minimum temperature	—5.45	—1.52	13.84	27.49	43.91
" daily range	16.95	20.73	18.15	18.67	20.62
Average pressure of vapour	0.050	0.065	0.112	0.178	0.301
Average humidity of the air	83	83	82	79	73
" temperature of the dew point	3.0	9.0	20.8	31.6	45.2
Amount of rain in inches	R.	0.52	1.04	2.38	4.69
Difference from average	—0.59	—0.02	+0.17	+0.87	+2.37
Number of days of rain	1	2	8	15	17
Amount of snow in inches	30.0	26.0	2.5	5.9	......
Difference from average	+7.8	+2.8	-12.2	+0.7	*
Number of days of snow	13	12	6	5	.....
Percentage of sky clouded	65	59	51	56	58
Average velocity of wind	5.95	7.32	9.81	9.70	8.20
Auroras	0	2	1	1	0

at Ottawa for the Year 1893.

MONTHS.							YEAR.
June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
29.985	29.922	29.993	30.020	30.066	30.033	30.120	30.022
30.217	30.219	30.268	30.364	30.608	30.733	30.956	30.956
29.616	29.589	29.483	29.534	28.957	29 491	29.357	28.957
0.601	0.630	0.785	0.830	1.651	1.242	1.599	1.999
68.05	66.67	65.94	53.56	48.03	32.68	11.53	39.41
+1.85	—2.63	—0.66	—4.44	+3.38	—0.69	—4.56	—1.71
91.5	88.3	94.8	76.3	72.9	54.2	37.0	94.8
49.5	49.0	45.5	34.9	21.5	7.5	—25.2	—26.2
42.0	39.3	49.3	41.4	51.4	46.7	62.2	121.0
78.79	78.50	77.83	62.92	58.75	38.58	21.46	....
58.05	56.74	55.95	44.44	38.68	24.85	0.45	....
20.74	21.76	21.88	18.48	20.07	13.73	21.01	19.40
0.545	0.486	0.504	0.338	0.272	0.161	0.080	0.258
78	73	78	80	76	82	85	79
61.4	58.2	59.2	48.2	42.5	29.1	11.0	....
4.40	5.67	8.04	3.24	1.18	1.43	0.51	33.10
+1.74	+2.54	+4.80	+0.58	—1.25	—0.18	—0.21	+10.82
13	14	15	15	9	10	5	124
....	....	....	....	*	5.0	44.0	113.4
....	....	....	....	—1.0	—4.6	+20.4	+13.9
....	....	....	....	1	11	19	67
49	52	52	55	55	65	67	57
5.40	6.11	5.06	5.69	7.75	7.42	8.24	7.22
0	0	2	3	3	0	1	13

Frequency of the Different Winds at 7 a. m., 2 and 9 p. m. Daily.

--	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
January........	1	4	21	1	1	1	28	10	26
February	5	5	14	3	5	5	26	7	14
March	10	2	17	1	10	24	19	6	4
April	10	4	17	2	9	9	21	9	9
May	5	1	22	3	12	15	16	8	11
June	8	12	6	7	20	9	16	1	11
July	4	1	4	3	12	8	33	16	12
August	15	7	10	2	11	7	17	17	7
September......	9	5	6	4	13	11	21	12	9
October..	3	4	20	3	20	17	9	11	6
November......	0	4	17	6	9	18	19	6	11
December......	4	7	21	1	5	17	18	10	10
Year.......	74	56	175	36	127	141	243	113	130

Coldest day of Year, 11th January. Mean temperature —17.°80.

First rain of year, 29th January.

First thunder storm, 8th April.

Last snow of season, 15th April, 5 inches fell.

Last frost of season, 29th April.

Warmest day of year, 15th June. Temperature 76° 48.

Heaviest rain storm of year, 28th-29th August, 3.92 inches fell.

First frost, 4th September.

First entry of temperature below 32°, 17th October, (28°.9.)

First snow 29th October, not measureable.

First entry of temperature below zero, 2nd December (—2°.)

Heaviest snow storm of year, 15th 16th December, 16 inches fell.

EXCURSION No. 1.

The date for the first Excursion has not yet been decided upon. It will probably be to one of the picturesque and favorite localities north of the Ottawa River. Due notice will be given by the Secretary when arrangements have been concluded.

MARINE BIOLOGICAL LABORATORY WOODS HOLE LIBRARY MASS.

MARINE ... MASS.

OTTAWA FIELD NATURALISTS' CLUB.

Treasurer's Balance Sheet Club Year ending 20th March, 1894.

RECEIPTS.

Balance on hand from 1892-93		$34 20
Subscription fees received :—		
Arrears of previous years	$68 00	
For current year	149 00	
For 1894-95 (paid in advance)..........	6 00	
		223 00
Received for advertisements in NATURALIST.......		24 00
" " "authors' extras"		4 25
Net proceeds of excursions		24 35
		$309 80

EXPENDITURE.

Printing Ottawa NATURALIST Vol. VII...........	$216 13	
Postage on same.............................	14 45	
		$230 58
Printing "authors' extras"		9 75
General printing and stationery..............		5 35
" postage..............................		10 20
Expenses of soirees..........................		21 00
Book-case for library........................		7 00
		$283 88
Balance on hand..........................		25 92
		$309 80

A. G. KINGSTON,
Treasurer.

OTTAWA, 20th March, 1894.

Audited and found correct.

J. BALLANTYNE, } *Auditors.*
WM. A. D. LEES, }

OTTAWA EAST, 28th March, 1894.

REPORT OF THE BOTANICAL BRANCH, 1893.

To the Council of the Ottawa Field-Naturalists' Club :

The Leaders have much pleasure in reporting that a considerable amount of good work has been done during the past season, several new plants not previously reported from this locality having been discovered by members of the Club at the Excursions and sub-excursions. Good work has also been done at excursions made by one or two members who have visited localities too far distant to be reached by the whole section. Excursions were made to various points on the Gatineau Valley Ry. by Messrs. R. B. Whyte and John Craig and Prof. Macoun. Mr. Scott and Mr. Fletcher made several visits to the Mer Bleue and Cassleman, and made interesting collections. Mr. R. H. Cowley makes the following interesting report : " The colony of the introduced North Western plant—*Grindelia squarrosa*—first observed some years ago at the old Eddy mill-site in Nepean, is still in a prosperous condition. It is multiplying rapidly and seems to have found a congenial habitat." During the third week of August Mr. Cowley paid a brief visit to Clarendon, in Pontiac County, and visited a few of the neighboring islands in the Chats Lake, on all of which he found many specimens of *Lobelia Kalmii*, *Potentilla fruticosa*, *Pycnanthemum lanceolatum*, and *Aster ptarmicoides* in full flower. The last three were first found by Mr. R. H. Cowley and Mr. R. B. Whyte on the Chats Island in 1891.

The following plants may be mentioned among the more interesting of the season's collections :

RANUNCULUS SCELERATUS, L. This addition to the *Flora Ottawaensis* was made by Mr. R. B. Whyte. The specimen was found at Borthwick's Springs on July 8th.

MYRIOPHYLLUM ALTERNIFOLIUM, DC. Specimens of this rare water weed were found by Mr. Wm. Scott in Brigham's Creek, Hull, Que. They were in fine condition in September and were growing in about a foot of water. The only other recorded locality for this plant is " Lake Memphremagog, July, 1866." (Macoun's Cat. V, p. 322.)

LONICERA CÆRULEA, L. The two bushes of this species which grow near the gas spring in the Mer Bleue were visited this year and good specimens obtained.

L. OBLONGIFOLIA, Muehl. In a small swamp 4 miles past Casselman on the right hand side of the railway, there are hundreds of bushes of this pretty honeysuckle. The bushes are about three feet high, oval and symmetrical in shape. The long pedicelled flowers, which distinguish this from the last species, open early in June and are followed by the two purple, nearly distinct berries in July.

SENECIO AUREUS, L. var. BALSAMITÆ T. & G. Specimens of this variety were collected by Mr. Cowley near the old Bristol wharf up the Ottawa, growing below high water mark in crevices of limestone rocks.

ARTEMISIA CANADENSIS, Michx. This interesting addition to our local flora was made by Mr. W. E. Saunders, who found it growing on the rocks below the Hog's Back. It has also been found at Mermaid Mountain, Wakefield, by Mr. R. B. Whyte.

LACTUCA SCARIOLA, L. The Prickly Lettuce, an introduced plant, was found by Mr. Fletcher along the Canada Atlantic Ry. near Stewarton and good specimens were secured.

PHYSALIS VIRGINIANA, Mill. On a few sandy knolls in a meadow at Clarendon Mr. Cowley found some vigorous colonies of this plant. There were mature fruit and fresh blossoms on the same specimens although the plants had been cut down by the mowers only a few weeks previously.

LOPHANTHUS NEPETOIDES, Benth. This is a rare plant here, so far having only been found at Casselman; good specimens were collected this year by Mr. Scott.

AMARANTUS BLITOIDES, Watson. Found at the side of the road which leads from Rockcliffe to Hemlock Lake by Mr. Scott. (Sep. 3). This species had evidently been overlooked by less wide-awake collectors than Mr. Scott. It has much the appearance of the prostrate form of *A. albus*, L. which frequently grows in roads; but can at once be separated when examined.

In *A. albus* the floral bracts are twice longer than the flowers, while in *A. blitoides* they are shorter than the flowers, and the seed of *A. albus* is less than half the size of that of *A. blitoides*.

LISTERA AUSTRALIS, Lindl. A bed of this rare little orchid, not previously recorded as having been found in Canada, was discovered by

Mr. Fletcher, beyond the Poplar Ridge in the Mer Bleue on June 21.

ARETHUSA BULBOSA, L. This lovely orchid was found in great profusion by Mr. Scott near the gas spring in the Mer Bleue in the second week of June.

POLYGONATUM GIGANTEUM, Dietr. Half a dozen specimens of this handsome plant were collected about a mile and a half from Casselman by Mr. Fletcher. They were growing in low ground along the Canada Atlantic Railway and undoubtedly indigenous. Stems 3-4 feet high, peduncles 3-6 flowered. The occurrence at Casselman of this and such plants as *Thaspium aureum*, Nutt., *Aster Novæ-Angliæ*, L., *Rudbeckia laciniata*, L., *Helianthus decapetalus*, L., *Phlox divaricata*, L., *Saururus cernuus*, L. & *Carya alba*, Nutt. is very remarkable, for all belong to a flora much more western and southern than that of Ottawa.

POTAMOGETON VASEYI, Robbins. Fine specimens of the rare form with emersed leaves and fruit spikes were collected by Mr. Scott, in August, at Kettle Island.

ERIOCAULON SEPTANGULARE, Withering. Specimens of this curious plant were collected in Lake Harrington, Que., on September 22. It had once previously been found by Mr. Latchford at Masham, Que.

ERIOPHORUM RUSSEOLUM, Fries. The cotton rushes were exceptionally beautiful last season. *E. vaginatum*, L., with large silky white heads and the similar *E. russeolum* with its no less handsome tufts of tawny silk were very conspicuous in the Mer Bleue. *E. gracile*, Koch, and *E. polystachyon*, L. formed large beds of waving white tassels along the railway from the St. Louis Dam to the Rideau River. Later in the season *E. Virginicum*, L., both the type and the white variety were abundant at the Mer Bleue.

HELEOCHARIS TENUIS, Schultes. This species omitted from the Flora has been found by Mr. Cowley at Clarendon. It also occurs at several places about Ottawa.

ERAGROSTIS REPTANS, Nees. Two localities for this pretty little grass have been discovered near Ottawa by Prof. Macoun. On the road along the Ottawa to the west of the wharf at Buckingham in September, 1891, and in the same month in a disused quarry to the north of Brigham's Creek, Hull, Q.

Phragmites communis, Trin. A few patches of about 6 stems were found in a swamp 4 miles past Casselman.

Glyceria elongata, Trin. Large beds of this elegant and rare grass occur along the streams running into the Nation river, along both banks, at Casselman. Specimens were found at the same place by Mr. Fletcher ten years ago, but it had not been collected since till rediscovered again this year by Prof. Macoun and Mr. Scott.

Aspidium aculeatum, Swartz, *var.* Braunii, Koch. Several fine specimens of this fern, together with *Comptosorus rhizophyllus*, Link, and *Asplenium Trichomanes*, L. were found on September 22nd in a ravine near old Chelsea.

In conclusion the leaders beg to express the regret they feel that Mr. Wm. Scott has left Ottawa to reside in Toronto, knowing how much the section owes to the energetic and enthusiastic manner in which he has assisted of late years in working up the flora of the Ottawa district. They trust, however, that he may find it possible to join us in many future excursions.

R. B. WHYTE,
JOHN CRAIG, } *Leaders.*
R. H. COWLEY,

FIRST EXCURSION, 1894.

Of the many delightful excursions held by the Ottawa Field-Naturalists' Club during the fifteen years of its active and prosperous existence, that of Saturday, May 26th, may well be awarded a first place as a typical Outing. It was not quite so large as that of last May, but in addition to the ordinary train accomodation, three special cars were required to convey the happy and enthusiastic party of Nature's students and admirers. Leaving the city at 1.30 p.m. the Chelsea station was soon reached and Vice-President Shutt announced the programme of the afternoon. The members rapidly dispersed through the adjoining fields and groves, armed with plant-boxes, insect-nets, hammers, cameras, sketch-books and other impedimenta. The Gatineau river, here flowing through a picturesque gorge in the forest-clad hills, naturally attracted a large proportion of the party, and the beautiful falls and rapids over which the swift waters madly rush, called forth many exclamations of genuine pleasure and admiration. It was an

ideal afternoon for vigorous exploration or for more leisurely sauntering, and the bright sun and clear sky formed a pleasant contrast to the gloom and dampness of the Wakefield excursion last year. The afternoon passed rapidly and pleasantly in profitable investigations of the surrounding region, and in enjoyment of the many beauties of this wild and romantic stretch of the dark, turbulent river. At 6 p.m. as previously arranged, the party reassembled at the station to hear the Leaders explain and discuss the collections of the day, or refer briefly to special features of interest in connection with the neighborhood or the several branches of investigation. Mr. Shutt, after congratulating the members and their friends upon the profitable and delightful character of the excursion, called attention to the fact that the Club was honored by the presence of Dr. Scudder, of Cambridge, U.S., Prof. Fowler, of Kingston, and Dr. McKay, of Halifax, and that these eminent gentlemen would kindly say a few words to the assembly when the Leaders had delivered their five-minute addresses. Mr. Cowley rose first as Botanical Leader and pleasantly discussed some of the plants collected, including those belonging to the lily and orchid families. He was followed by Mr. Whyte who spoke especially of the representatives of the great rose family, pointing out how unusually early the various species had flowered this season, and what favorable indications there were for a large and early fruit-crop. Prof. Fowler spoke in forcible terms of the way in which he had been impressed by the romantic and beautiful scenery, and of the great pleasure which such views of rugged hills and broken river afford to one whose time is mostly passed amid the more peaceful landscapes of a level country. Mr. Fletcher briefly stated the pleasure and advantage to be obtained from the study of his favorite butterflies, and outlined in a very interesting manner the life of these beautiful "flowers of the air." Dr. Scudder's brief speech included some humorous remarks on the methods of investigation pursued by the friendly mosquito, of which he had noted three species during the very enjoyable afternoon. Dr. Ami referred briefly to a deposit of Saxicava sands which occurred not far up the railway track, containing various marine shells, and proving that in past ages the ocean surf had thundered against the rocks of these

Laurentian hills. The hour of departure was rapidly nearing so several of the Leaders had to be omitted and Dr. McKay appropriately concluded with a very enthusiastic expression of the pleasure and profit with which he had followed the proceedings of the afternoon. The knowledge which he had thus acquired of the working methods of the Club, he hoped to utilize in connection with the natural history society which existed in Halifax. The city was reached at 8 p.m., and electric cars were in waiting to carry home the satisfied field-naturalists.—(Ed.)

BREPHOS INFANS, MOESCHLER, AT OTTAWA.

A good specimen of this rare and beautiful moth was taken on April 12th in the firwoods behind Rideau Hall by Lady Marjorie A. Hamilton-Gordon. One had been seen at the same spot two days previously, flying high up among the trees. *B. infans* is a very showy moth ; it expands over an inch and a quarter, having the upper wings of a deep mottled brown crossed by two white bands towards the tips ; the under wings are bright orange-scarlet margined with black, and have also a broad black band running from the base to the anal angle from the end of which a narrow zigzag extensions runs across the middle of the wing.

The genus *Brephos* belongs to the small family Brephidæ of which there are only five species catalogued from North America, three of which belong to *Brephos* and two to *Leucobrephos*. Dr. Packard says of this family as follows (Guide to the Study of Insects, p. 316) :—

"In *Brephos* the hind wings are bright orange, the body is hairy and the antennæ are ciliated ; the abdomen is slender, and the wings are broader than usual. The larva is smooth, elongate, with 16 legs, though the first two abdominal pairs are useless for walking ; hence the larva has a semi-looping gait. It feeds on trees and makes a slight cocoon in moss or under bark. *B. infans* Moeschler inhabits Labrador and New England. It flies early in April before the snow has left the ground."

Lady Marjorie has collected several other good insects this spring but the species mentioned above, has previously been looked for in vain by Ottawa collectors.

J. F.

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A BROOD OF FLICKERS AND HOW THEY WERE FED.

By A. G. Kingston.

In an article under the above title published in *The Auk* for July last Mr. Wm. Brewster, the well-known ornithologist, of Cambridge, Mass., recounts some highly interesting observations made by him on the breeding and feeding habits of a pair of these woodpeckers.

The decayed tree in which the nest had been excavated in this instance was accidentally broken off when the nestlings were about a week old, in such a way as to leave them almost entirely uncovered; and Mr. Brewster, by concealing himself not many feet away, was able to view clearly all the operations of this woodland nursery. His notes are given in minute detail. They show that in this species the young are fed by *regurgitation*.

The old bird used to visit the nest to feed the young at intervals of from twenty to sixty minutes. It was seen that no food was carried in the bill and apparently little or none in the mouth or upper throat; but looking down into the five clamourous and wide-open mouths, the parent would plunge its bill deep into the first, "as if," says the writer, "with the design of piercing its offspring to the vitals," and by a series of quick, convulsive movements, would seem to pump up the food from its own stomach and inject it into that of the young bird. And so with the next nestling and the next, until all were satisfied or the store was exhausted. The prey of the Flicker is known to consist largely of ants, together with such larvæ, &c. as inhabit dead wood; and it is apparent that by swallowing each insect as soon as captured, the bird would be able to collect, and hold securely to the end of the trip, sufficient food to supply the whole or a large portion of the family.

It is pleasing to learn that in spite of the exposure to the weather through the unroofing of their home, and in spite of the loss of the mother bird, which seems to have been destroyed about the time that Mr. Brewster began his observations, the whole five nestlings were safely reared, at least until able to fly away from sight.

Opportunities like this for studying the breeding habits of woodpeckers and other birds that breed in holes are rare indeed, but they may occur to any student of bird life. One who is lucky enough to stumble on another such chance should not fail to use diligently both eye and pencil.

THE TRANSMUTATIONS OF NITROGEN.

By Thos. MacFarlane, M.E., F.R.S.C.

I am to speak to you this evening about Nitrogen. Very likely I might not have had the honor of thus addressing you had I not felt bound to try to repay your worthy Vice-President, Mr. Shutt, for the kind turn he did St. George's Church Association in lecturing to them a year or two ago on Oxygen, an equally important element, but much more energetic and meddlesome than Nitrogen. Now since Oxygen and Nitrogen may be said to be partners in many of the operations of nature, I may be said, in giving this lecture, to be paying Mr. Shutt back in his own coin. I prefer this expression and must carefully avoid referring to the transaction as an exchange of gas, for "gas" has come to be used as a figurative expression for other things besides oxygen and nitrogen: in fact, generally speaking, for eloquence of an unreliable character. Of course it is part of my task to-night to avoid eloquence of this nature and confine myself to sober and well authenticated facts.

In choosing "Nitrogen" for my subject to-night it has seemed to me that I could not do better than call attention to this more abundant, although less active and less positive constituent of the atmosphere, and trace certain of the wonderful changes which it undergoes in nature, for nitrogen, no less than oxygen, performs its rounds, and moves in stupendous cycles through the inorganic, the animal and the vegetable worlds. Not unfrequently, these changes are so mysterious, and their results so strange and inexplicable that I have ventured to characterise them as transmutations. This term, as you well know, is applied to the supposed process in which the old alchemists believed, by which one metal was supposed to be actually converted into another; and more especially base metals changed into gold. Conversions almost as miraculous, transformations almost as astonishing are produced in the properties of the compounds into whose composition nitrogen is introduced. That element assists by turns in building up an atmosphere, a food, a poison, a colour, the bloom of a flower, the fibres of a muscle, the feathers of a fowl, the force of an explosive. We may therefore truly speak of its transmutations.

But what is Nitrogen? A simple body, colorless, tasteless, inodorous, as the chemical text books tell us. And they used also to say that it was always gaseous when uncombined. So it is at ordinary temperatures, but it can be frozen at 346° below zero Fahrenheit when under enormous pressure. Then it becomes, according to Professor Dewar, a white crystalline substance. His apparatus for producing it cost something like £5000 and cannot very well be reproduced here. But although we cannot have the solid nitrogen we have plenty of the gas. When the ladies use their fans it is mainly to put nitrogen in motion. It is the sleeping partner of oxygen in carrying on the business of the atmosphere. It is a mysterious element, fickle, indifferent and unstable, but it is most abundant and constitutes four-fifths of the ocean of air at the bottom of which we live, move and have our being. The experiment which demonstrates this is very old, but like a good story is none the worse of being twice repeated.

All the interesting positive properties of the atmosphere are due to oxygen. Nitrogen is only present as a diluent, a restraint, a drag. It is mixed with the oxygen in a mechanical sort of way to prevent its doing too much damage, like water in whiskey. There is no intimate chemical combination betwixt the gases of the atmosphere. In fact nitrogen does not combine willingly with the other elements and is always ready to part company with them at very short notice.

The question "What is nitrogen?" can, however, be asked and answered with the same significance as the enquiry "What is butter to-day?" when asked by purchasers at the market. Nitrogen has its price like butter, and in fact the latter is sometimes sold at no higher price per pound. Here we have three jars containing respectively dried blood, sulphate of ammonia, nitrate of soda; all articles of commerce and used in Canada chiefly as fertilisers. All contain nitrogen, although in different combinations, and in all of them the nitrogen is worth about 16 cents per pound. Inside of these bottles then its value is considerable; outside of them, in the atmosphere, it is valueless. Inside the bottles it is combined, outside it is free; free as air and as cheap. But just fancy how rich we should all be if this free nitrogen could be fixed and realized in the form of money. Fifteen pounds of air press upon

every square inch of the earth's surface ; that contains 12 lbs. of nitrogen at 16c. ; very nearly $2 per square inch or $288 per square foot. If we calculate at these rates the value of the atmospheric nitrogen resting upon a square acre it amounts to twelve and a half million dollars and on a farm of 100 acres one thousand two hundred and fifty millions. It would be quite interesting if we were to give a history of the attempts that have been made to realize or fix this nitrogen and get it into the form of ammonia, nitric acid or cyanogen. But the chemists have all failed to do this economically and the only person who has it in his power to utilize it to a certain extent is that humble individual the farmer.

For nearly a century and a quarter the question of the utilisation of nitrogen by plants has been a subject of controversy among scientific men. It was the famous Priestly who began it in 1771. He and, a few year's later, Ingenhous pointed out that plants are able to assimilate very appreciable quantities of nitrogen from the air. Saussure denied this, so did Woodhouse and Sennebier, all of them basing their conclusions upon experiment. The famous Liebig also wrote on the same sides. Then the question slept until 1851 when Boussingault renewed the controversy and both he and George Ville from their experiments maintained the affirmative side of the discussion. A commission of the Academy of Paris took their side, but later Cloëz, Mène, Hartung and Gunning came to an opposite conclusion. In 1861 Lawes, Gilbert and Pugh ranged themselves on the negative side, but Bretschneider two years later made experiments with lupins and dwarf bean plants obtaining most positive proof of the assimilation of atmospheric nitrogen. Perhaps the conflicting conclusions previously arrived at had been owing to a want of sufficient care in the observations made on different sort of plants. In any case Bretschneider's results only confirmed what was known about the cultivation of the papillionaceæ away back in the time of the Romans. W. Strecker has disinterred a passage in Pliny (Natural History: Book XVIII.) of which this is a translation ; "Lupins, Lentils or Pulse require so little manure that they in fact replace it ; Vetches make the land fertile. Corn should be sown where previously lupins, vetches or beans have stood, because these only make the land more

fertile." Here we have the experience of antiquity agreeing with the practice of the modern intelligent farmer who ploughs clover into the ground in order to obtain a good crop of wheat.

From 1863, experiments and disputations on the question again ceased until 1881, when an intelligent land owner in North Germany, named Schultz, published his experiences in farming, and awakened the attention of the agricultural world of Europe. Both practical farmers and scientific agriculturists are now fully agreed that the fixation of nitrogen by leguminous plants is a reality. The most decided pronouncements ever made on the subject were delivered at Halle, in January, in 1891, at the 64th meeting of German investigators and physicians. Prominent among those were Maercker, Wagner and Hellriegel, but American and English authorities were also present including Atwater, Lawes and Gilbert. The last named gentleman, Sir Henry Gilbert, who visited Canada a few months ago, gave a discourse on the fixation of free nitrogen from atmospheric air by plants. He had presided in 1886 at Berlin, when Hellriegel gave the results of his first investigations regarding the question of nitrogen and the leguminosæ. Previously, in 1884, Hellriegel had brought the formation of the little bulbs on the roots into connection with the fixation of nitrogen. Sir Henry Gilbert told his audience that at Rothamsted, since 1888, elaborated trials on this subject had been carried on, the characters of which were illustrated photographically. Those experiments entirely confirmed Hellriegel's results. They shewed that peas, vetches, lupins, lucerne, white and red clover, are all capable of directly assimilating nitrogen, although in different measure. The lecturer discussed minutely the nature and action of the tubercles, without however coming to very decided results as regards their mode of activity. Some of them are as large as walnuts, and the investigators are still inclined to believe that the bacteria they contain are instrumental in digesting the nitrogen. Hellriegel was of opinion that the study of these tubercles was far from ended, and would occupy them a long time yet. He stated that peas are unable to appropriate either nitric acid or ammonia from the soil; that lupins cannot thrive when supplied with nitrate of lime, but perhaps with nitrate of ammonia. Meyer was glad to be able to observe that although Hellriegel's investigations had overtaken and

passed those of Rothamsted, the work was being continued in the friendliest manner, and utterly free from envy and dispute.

From these memoranda regarding this great meeting of agricultural scientists at Halle, it will be seen that the fixation of atmospheric nitrogen by plants of the sub-order papillionaceæ, is now established beyond all possibility of doubt, and that that farmer will be the truest artist and become the richest man who makes the best use of these well established results of scientific investigation in agriculture.

But although it is a fact that these humble leguminous plants are so highly gifted by nature, it is equally certain that the cereals and other plants of a higher order cannot appropriate nitrogen in this direct way. They and their rootlets must search for it in the soil in the form of nitric acid, which may have been brought from the atmosphere into the soil or have originally existed as nitrogen in its organic matter or humus, or may have been produced by the oxidation of ammonia. Decayed vegetable matter, peat and black muck contain quantities of nitrogen varying from ¼ to 2 per cent. in the air dried condition. When this is composted or mixed with other soil and stable yard manure the nitrogen is gradually made available for plant food; in fact it undergoes a process of oxidation, being first changed into ammonia and then if bases are present into nitric acid. This lecture would certainly be incomplete without some notice of these important compounds. We shall now make some reference to ammonia; later on to nitric acid.

(Here experiments were introduced illustrative of the great solubility and alkaline character of ammoniacal gas; the formation of ammonium chloride and the oxidation of ammonia in the ignition of the bichromate.)

But it is our business this evening to go further and ask what use the plant makes of the nitrogen which it appropriates. It is immaterial whether we suppose that the nitrogen is assimilated as such or as ammonia or as nitric acid, in any case the use which is made of it by plants, and the wonderful products into which it is transformed by the vital activities at work in these, are simply miraculous. A very high authority, Mr. Warington, a colleague of Sir Henry Gilbert and Sir

John Lawes in the investigation at Rothamsted thus expressed himself on this wonderful peculiarity of the vegetable world:—"The immense variety of substances produced in the vegetable kingdom has always been a source of astonishment to the chemist. The plant is indeed the finest chemical laboratory with which we are acquainted. While some kinds of chemical work are common to all plants, there is hardly a species which does not possess some special capabilities, which does not produce some products different from its neighbors. When we survey the whole vegtable kingdom, the extent to which this specialisation is carried, and the immense variety of the products obtained become simply overwhelming. Chemists are still unacquainted with the larger part of the substances produced by plants. When we turn from the products of plant work to the materials employed our wonder still increasés, for these materials are of the simplest kind—water, carbonic acid, oxygen, nitric acid and a few inorganic salts—yet out of these the whole of the immense variety of vegetable products is constructed."

In the interesting lecture by Mr. Shutt to which I have already referred, he traced the travels of oxygen and the manner in which that element carries carbon to the vegetable kingdom, and assists in storing it up in plants in the form of carbohydrates, such as starch and sugar and cellulose. These substances are, however, quite destitute of nitrogen, and we cannot say much about them now. We are tracing now the fortunes of nitrogen, and that element occupies itself in the plant in building up an entirely different set of compounds from the carbohydrates, namely, the albumenoids, or as Beilstein calls them the albuminates, or as Mulder christened them the proteids. In casting round for the word which indicates popularly those of them which occur in the vegetable world, I should be inclined to fix on the word gluten, but that substance is only a mixture of insoluble albumenoids, and it is doubtful as to whether it exists in the original grain.

No doubt this general name of albumenoids has been conferred upon all these bodies from the resemblance they bear in some of their properties and always in chemical composition to ovalbumen or white of egg. This substance is soluble in water in its natural state and coagulates on heating.

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The albumenoids, whether of vegetable or animal origin have been characterised as "infusible, non-volatile amorphous solids, neutral in re-action and indifferent in combination." Thus it seems that their characterising element nitrogen has been able to impress its own individuality upon them, and the most characteristic chemical re-action they can show in one indicating the presence of nitrogen. When they are well dried and heated with soda lime, or even alone, they give off ammonia, which can be recognised by smell and reaction. There is always produced a disagreeable smell on burning nitrogenous substances (wool); not so when nitrogen is absent; (cotton).

The composition of animal and vegetable albumenoids is very nearly the same, and their chemical properties very similar. It is not usual to recognise the properties of white of egg in vegetable products, but it can be shown that a similar substance may be obtained from wheaten flour. On shaking some of it up with cold water, and filtering, a solution is obtained which coagulates on heating, on admixture with dilute acids, alcohol, &c.

The precipitate produced when the cold solution from wheat flour is heated is called plant albumen, but if this be filtered off and a little acid added to the filtrate we obtain a separation of what is called legumin or vegetable casein. This sort of casein is the chief albumenoid formed in the leguminosæ, in peas and beans, in their little laboratories, whenever they undertake, as is their proud privilege, to utilise the nitrogen of the atmosphere.

But the proteids which the cellular tissue of a plant manufactures from its nitrogenous food are not all soluble in water. In fact, however soluble they may be in the plant itself, comparatively little of them in quantity is found to be so after we get them into our hands. If we make a little dough from wheaten flour and knead it enclosed in a piece of calico, either in water, or with occasional immersion, the starch of the flour exudes through the small holes in the cloth, along with the soluble proteids. If this kneading is continued until no more white particles can be kneaded out, and the cloth is then opened there is found inside a grey coloured, elastic, sticky substance, which is known as "crude gluten." Its stickiness is characteristic; the Germans call it "kleber,"

from the verb kleben, to stick. "It is the presence of gluten in wheaten flour that imparts to it its viscidity or tenacity, and confers upon it its peculiar excellence for the manufacture of macaroni, vermicelli and similar pastes. The superiority of wheaten over other bread, depends upon the greater tenacity and elasticity of its dough and this is owing to the presence of the "gluten" we are speaking of. The dough during the fermentation and baking is puffed up by the evolved carbonic acid, and so stretched out as to produce the vesicular texture, so much valued in the light loaf."

This gluten is eminently nutritious, because it consists of albumenoids, which though insoluble in water, are easily acted on by the digesting fluids. It is not, however, a simple chemical compound but consists very largely of gluten fibrin. That it is highly nitrogenous may be proved by applying the same test as in the case of the white of egg.

The percentage composition of gluten fibrin I shall write down alongside of the other albumenoids, so that you may see how very little they vary from one another.

PERCENTAGE COMPOSITION.

		C.	H.	N.	S.	O &c.
Proteids (Vegetable)	Plant Albumen (from wheat)	53.10	7.20	17.60	1.60	20.50
	Legumin (peas)	51.50	7.00	16.80	0.40	24.30
	Gluten Fibrin (wheat)	54.30	7.20	16.90	1.00	20.00
Albumenoids (Animal)	Ovalbumen	52.5	6.9	15.25	1.93	23.42
	Casein	53.6	7.1	15.70	1.00	22.60
	Fibrin of blood	53.4	7.0	18.10	1.20	21.30
General Molecular Formula		72.	112.	18.	1.	22

We shall recognize more fully the great importance of these vegetable albumenoids, or proteids as I prefer to call them, when we come to consider later on those of the animal kingdom. Meanwhile what we have again to point out is that these bodies so complicated in their composition and so curious in their properties, are built up in the interior of plants from such inorganic materials as nitrogen, ammonia and nitric acid by the agency of no other apparatus than those tissues

and cells we see when plants are microscopically and even macroscopically examined. In the infancy of chemical science it was customary to call in the aid of the vital principle in further explanation. It seems that we have now got beyond that; "nous avons changé tout cela" as the French say. I shall have, however, something more to say about this point before I close this lecture.

But those albuminoids are not the only compounds which plants are capable of forming with such inorganic nitrogen; many very wonderful compounds of different nature are stowed away in the root, stems, leaves and seeds of plants and trees which have nitrogen for an essential constituent. They are known as the alkaloids so much used in medicine. Although the plants and trees which yield the alkaloids grow in localities wide apart, at different altitudes, on soils of varying composition, and although they frequently come from very different parts of the plant, from the roots, the stem, the bark, the sap, the leaves and the seed, yet the fact that plants cannot elaborate these curious and valuable and dangerous substances without nitrogen, ammonia or nitric acid is common to them all. Among them are caffeina, which in tea, coffee and cocoa cheers, but not inebriates; quinia, the great fever remedy, from the bark of shrubs and trees of the tribe cinchonaceæ growing on the west slope of the Andes; morphia, from poppy juice, well known for its sedative powers and regarding which it has been remarked that by its judicious employment more happiness and by its abuse more misery has been produced than by any other drug used by mankind. Aconitia, mostly used in the anodyne liniment, seems to be to the human body outwardly what morphia is internally, a soother of pain. But it as well as atropia, brucia and strychnia are also known as the most powerful poisons. They are in appearance very innocent individuals, but they are terribly dangerous at close quarters.

The following formulæ show the composition of some of these bodies:—

Caffeina $C_8\ H_{10}\ N_4\ O_2 + H_2O$.

Quinia $C_{20}\ H_{24}\ N_2\ O_2 + 3H_2O$.

Morphia $C_{17}\ H_{19}\ N\ O_3 + H_2O$.

Aconitia $C_{33}H_{43}N\ O_{12}$.

Atropia $C_{17}\ H_{23}\ N\ O_3$.

Brucia $C_{23}\ H_{26}\ N_2\ O_4$.

Strychnia $C_{21}\ H_{22}\ N_2\ O_2$.

We must not however go farther afield in noticing these products of the transmutation of nitrogen. Il faut que nous revenons a nos moutons ; we must return to our mutton or rather to the substances which make our mutton, for it must not be forgotten that proteids are also to be found in the grassy plants. This has been fully shown by Mr. Shutt in his reports and he has even proved that "the percentage of albuminoids is higher in a grass before flowering or when in flower than when the seed is fully formed." He tells us that, "as the seed matures there is a migration of the albuminoids of the leaf and stalk into the seed," a very interesting fact and only less wonderful than the first formation of these important substances.

Valuable and important substances they are indeed, for the researches of Liebig went to prove, nearly fifty years ago, that these albuminous compounds are formed in the vegetable kingdom alone ; that the animal body possesses only the power of appropriating them and converting the one into the other. Animals are entirely dependant on vegetables for a supply of the substances out of which first blood, and then from that fluid all the solids of the body are produced. For this reason the food of animals must contain these albumenoids ready formed.

This is not the first time you have been told that "All flesh is grass," but that has been to you for the most part a figurative expression. It is, however, true in a very literal sense. Flesh, that is to say, the fibrin of the muscles, the insoluble albuminoid of the animal kingdom is derived from the albuminoids of grass, vegetables, cereals, and leguminous plants. With these we follow the fortunes of Nitrogen from the vegetable into the animal kingdom. The great mass of the dry organic constituents of the animal tissues consists of these amorphous, nitrogenous, complicated substances of high molecular weight, and it is very well worthy of remark, that although the carbo-hydrates, starch, sugar, and even cellulose, play a most important part in animal nutrition and economy, they do not form part of what may be called the permanent constituents of the bodies of animals. Take for instance the body of a man of 11 stone or 154 lbs. ; it has been estimated that

111 lbs. or more than two thirds, consist of water. The remaining 43 lbs. consist of the following proximate constituents :—

	lbs.	oz.
Phosphate and carbonate of lime with fluoride of calcium forming the earthy matter of the bones....	7	..
Other phosphates and carbonates with chlorides, sulphates, silica, and iron oxide........	..	9
Fat, constituting the adipose tissue.........	12	..
Gelatine, of which the walls of the cells and many tissues of the body, as well as of skin and bones are composed.........	15	..
Albumen found in the blood and nerves.....	4	3
Fibrin forming the muscles, the clot and globules of the blood	4	4
Total......................	43.	0.

Thus out of 43 lbs. dry substances 23.7 are albuminoids, but taking the dry organic constituents alone, 23.7 lbs. in 34.7 lbs., or 66 per cent., consist of the nitrogenous constituents of which we have been speaking. The carbohydrates so far as they have contributed to the building up of the body are represented by the fat.

According to Hammarsten it has become customary to include the whole of the animal albuminoids under the name of proteines or proteids, which would seem to be rather an unfortunate arrangement. It is unnecessary to go so far back as to explain how and why this term was invented by Mulder for designating all these nitrogenous substances, but since it comes from a Greek word signifying "I am the first" it would appear more appropriate to apply it rather to the vegetable albuminoids and confine it to them only.

It will scarcely be expected that I should give in such a lecture as this a full description of the processes of digestion and assimilation, but it is our business to attempt to follow the proteids of the vegetable kingdom in the changes which they undergo in passing through the animal economy. We must leave almost unnoticed the fat and the

carbo-hydrates of food, and follow the proteids into the animal stomach where it is the special function of the pepsin contained in the gastric juice to render them soluble.

A word or two may not be out of place here regarding the digestive ferments. These are all nitrogenous bodies as is also the disatase of malt; but they are unorganised ferments or enzymes. They are quite different from the organized ferments, the vegetable or animal growths such as *Saccharomyces cerevisiæ*, which are said to provoke the various kinds of fermentations. Perhaps a good way to classify them would be to call the former ferments and the latter "varmints."

It does not appear that the digestive fluids of the intestinal canal such as the bile and pancreatic juice, are much concerned in acting upon the albuminoids of food or rather the peptones of the chyle. Their functions seem to be rather to convert sugar and fat into a condition for easy absorption. Elaboration follows absorption and ultimately these nutritive materials become part of the blood which conveys them to every part of the body, and affords to every organ and tissue a supply of the substances they stand in need of. Thus the nitrogen we have been following becomes part of the albuminoids of the blood, muscles and nervous system, and to its functions and transformations in connection with these I have now to invite your attention.

The blood, which constitutes about one twelfth of the weight of the body, and consists of the slightly yellowish colored fluid called the plasma or serum, and the blood corpuscles which swim around in it, is the fluid of life. It not only conducts to the various tissues and organs the substances which are necessary to their sustentation and growth, together with the oxygen required for changing the condition of the waste which they sustain, but it also takes up and removes from them all the substances which have served their purpose and become waste, in order to conduct them to the various organs of removal, the lungs, the skin and the kidneys, through which they obtain egress from the animal body. Formerly it was supposed that the various combinations and decompositions necessary to those operations took place in the blood itself. This view has, however, long since been recognized as erroneous, for none of the products of such decompositions are ever

found in the arterial blood. Chyle, lymph and blood are simply to be regarded as the means by which the transportation is effected of the decomposable and decomposed material; the decomposition or change itself is effected in the tissues. The various substances dissolved or suspended in the arterial blood, such as albuminoids, fat, sugar, salts and oxygen diffuse themselves through the fine capillaries of the blood vessels into the fluids of the tissues and here it is that they are subjected to all sorts of changes and transformations. The products of these are gathered up into the dark venous blood, which carries them away to be discharged from the body, while another set of fine tubes, the lymphatic absorbents, pick up all healthy superfluous fluid from the various tissues and return it into the circulation.

The albuminous substances thus spread all over the system are split up into more and more simply organised bodies, the final products being urea and uric acid. Just how this transformation is effected is far from being clearly understood. But there is not the slightest doubt about the fact tnat the substance urea, which contains nearly 50 per cent. of nitrogen, together with small quantities of uric acid and ammonia, is the ultimate product of the decomposition of the albuminoids in the animal organism, and is completely removed from the body by the instrumentality of the kidneys. Consequently the quantity of urea produced in the animal body furnishes a measure of the quantities of albuminoids consumed. The nitrogen of 100 parts of albuminoids is capable of producing 33.45 parts of urea and if the constituents of the latter are substracted from the albuminoids thus:

	C.	H.	N.	O.
In 100 pts albuminoids	53.53	7.06	15.61	23.80
In 33.45 urea	6.69	2.23	15.61	8.92
There remain.............	46.84	4.83	....	14.88

which are applied either direct to sustain the animal heat or are deposited in the body as fat. Thus, while the carbon, to a very large extent, of the albuminoids in common with that of the carbo-hydrates either promotes the production of fat or finds its way in the shape of carbonic acid to the lungs, and is so discharged into the atmosphere, a very different fate is experienced by the nitrogen. In some mysterious

way, in a manner not yet understood by physiological chemists, it is made to form part of this substance urea and in the form of that compound it is separated from the body.

A very pertinent question, and one of the greatest importance is this : What is the special function of nitrogen in the animal economy? To what purpose is this continuous stream of it which passes through the body? Why are the albuminoids so essential to life, apart altogether from their carbon which goes partly to sustain the animal heat? Liebig's theory is well known and it is probably the one which to-day, in spite of its defects, finds widest acceptance. It is simply this : The conversion of part of the substance of the muscles into urea produces the power which the muscles require in performing movement and work. The nitrogen which is discharged from the body is therefore the equivalent of the transformed fibre, and therefore of the developed power and of the accomplished work. But there have been many objections to this teaching. It has been maintained that the muscles do not form the material by the chemical transformation of which power is produced, but only the apparatus in which the change is effected. Voit showed that, although the supply of albuminoids to an animal might remain unchanged, the mechanical work performed by that animal might be increased at pleasure, and that without provoking any increase in the amount of nitrogen discharged. Lawes and Gilbert too proved that this quantity depended entirely upon the nitrogen contents of the food, and therefore that the consumption of the muscle substances was entirely independent of the work accomplished. But since the muscular power must have come from the nourishment some opponents of Liebig's theory have sought its cause in the combustion of the non-nitrogenous nutrients, and they feel themselves the more justified in doing this because Smith, Von Pettenkofer and Voit had established beyond doubt the fact that, with the increase of muscular activity, the quantity of carbonic acid exhaled from the lungs increased also. In 1870 Liebig admitted the defects of his first theory and and brought forward a revision or modification of it. He felt himself, however, obliged to admit that even his new explanations were not entirely satisfactory, and declared that the true theory of the origin of muscular power had not yet been discovered and could only be

expected from the far distant scientific investigations of the future. Here then we find ourselves face to face with one of the many questions to which scientists must answer, We don't know yet. Perhaps the activity and functions of nitrogen may bye and bye be located elsewhere in the body, and it is not impossible that it may have a closer connection with the nervous system than is now generally supposed. But what we are now quite certain of is that comparatively little of the nitrogenous substances or proteids of the vegetable kingdom remain permanently in the bodies of animals. A much larger quantity, or rather of their nitrogen, is made use of in simply sustaining the vital processes. Of the albuminoids thus consumed, say by the live stock on a farm, their carbon finds its way to the lungs in the shape of carbonic acid and their nitrogen is expelled chiefly in the liquid manure of the animals. This is a fact not yet sufficiently appreciated by our agriculturists generally, and much of the nitrogen thus expelled finds its way back to the atmosphere. When it is properly cared for by the farmer it does, or should, not escape from the soil of his fields. Our nitrogen thus travels back to soil or atmosphere after having completed its life-giving circulation through the vegetable and animal kingdom. If it is allowed to reach the atmosphere then the agency of the leguminosæ is required to recapture it. If it again becomes a part of mother earth it is pretty securely held and is subject to some changes which we have now to consider.

Animal matter containing nitrogen, when it finds itself in a soil which is destitute of bases such as potash, soda or lime, usually gives rise to the formation of ammonia, but when bases are also present further oxidation takes place to nitric acid with simultaneous formation of nitrates such as saltpetre. It was this fact which caused Chaptal to suggest nitrogen as a name for that element from words signifying "I give rise to nitre."

(Here the following experiments were introduced and explanations given ; combustion of phosphorus and carbon in nitrous oxide ; oxidation of nitric oxide to nitrogen tetroxide ; production of nitric acid from saltpetre. The lecturer also referred to the oxidation of nitrogen in the soil, and the manufacture of nitre in the the East Indies.)

The instability of the compounds of nitrogen has been referred to,

and although we can point to some animal substances of a very permanent character which contain nitrogen, nevertheless I am afraid we must admit that on the whole the subject of our lecture is a fickle and unreliable element. It is a constituent of almost every explosive, and these owe their effectiveness to the ease with which nitrogen and its associates part company and resolve themselves into gases, the sudden production and expansion of which fractures and ruins their environment, whatever that may be, unless properly confined or regulated. The chief raw material for the old explosive gunpowder was, as you know, saltpetre, but now, for the high explosives so-called, nitric acid is employed. The aim of the manufacturers of these new explosives, whose name is legion, is to get rid of all unnecessary constituents and employ only such as will resolve themselves completely into gas, and as much of that as can be produced. In place of sulphur and charcoal used of old in making gunpowder, cotton and various forms of cellulose, glycerine and even sugar have been substituted and nitrified or nitrised by nitric acid. In this way gun-cotton is produced as well as nitroglycerine. The latter substance is composed of $C_2\ H_5\ N_3\ O_9$ and when exploded 2 molecules of it yield 6 of carbonic acid, 5 of water, 1 of nitrous oxide and 4 of nitrogen, one part by bulk will yield on combustion.

554	volumes of	aqueous vapour
469	"	carbonic acid
39	"	oxygen
236	"	nitrogen
1298	volumes in all.	

But M. Noble tells us that the heat set free by explosion causes the gases to expand to eight times their bulk ; so that one volume of nitroglycerine will yield 10,384 volumes of gas while one part by bulk of ordinary gunpowder yields only 800 volumes. Noble was not the discoverer of nitroglycerine. The first inventor was Sobrero, in 1847 while a student in the laboratory of Pelonze at Paris. Noble began its manufacture 15 years afterwards in 1862. From that sleep of 15 years it has awakened with such violence as almost to make people wish it had never been invented.

(Continued on page 69.)

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POPULAR *vs.* SCIENTIFIC ORNITHOLOGY.

By A. G. Kingston.

As a sequel to my note on page 44 the following correspondence in succeeding issues of *The Auk* is worth reproducing :—

Mr. Wm. Brewster, writing in the October number, says :

" In an article which appeared in the July number of *The Auk* I " described at some length a peculiar process of regurgitation employed " by the Flicker in feeding its young, believing and indeed remarking " at the time—that the habit was unknown or at least unrecorded. It " seems, however, that it had been previously observed by Mrs. Olive " Thorne Miller, who published an account of it in 1890 in the *Atlantic* " *Monthly*, the article being afterwards (in 1892) republished in a col- " lection of essays entitled ' Little Brothers of the Air.'

" It is a pity that writers like Mrs. Miller—gifted with rare powers " of observation and blessed with abundant opportunities for exercising " them—cannot be induced to record at least the more important of " their discoveries in some accredited scientific journal, instead of " scattering them broadcast over the pages of popular magazines or " newspapers, or ambushing them in books with titles such as that just " quoted."

And Mrs. Olive Thorne Miller, in the January number, replies :

" Mr. Brewster's gentle admonition in *The Auk* of October last " seems to call for an explanation of my position. The reasons I turn " more readily to a literary than to a scientific channel of expression " are several, not to speak of the fact that I am naturally of literary " rather than scientific proclivities. There is first my great desire to " bring into the lives of others the delights to be found in the study of " nature, which necessitates the using of an unscientific publication and " a title that shall attract, even though it may, in a measure, ambush " my subject.

" Again, never having studied scientific ornithology, and having no " time at present, if I had the wish to do so, and moreover, having an " intense love of live birds, and an almost Buddhistic horror of having " them killed, I must admit of feeling the least bit out of my element

" among those who—to put it mildly—feel otherwise. Let those who " will spend their days killing, dissecting and classifying ; I chose rather " to give my time to the study of life, and to doing my small best toward " preserving the tribes of the air from the utter extinction with which " they are threatened. * * * * * "

ROYAL SOCIETY OF CANADA.

The thirteenth annual Meeting opened in the Convocation Hall of the Normal School on Tuesday, 22nd May. Dr. G. M. Dawson, President, occupied the chair, and a large number of the Fellows were in attendance, with numerous ladies and gentlemen also interested in literature and science. Their Excellencies the Governor General and the Countess of Aberdeen were present, and an address of welcome was read by the President. His Excellency responded in appropriate terms, and warmly congratulated the society on the success which had accompanied its labours. The voluminous Report of the Council was then read by the Hon.-Sec., Dr. Bourinot, after which the sections organized and proceeded to the reading and discussion of papers.

In the evening Dr. Dawson delivered his President's address, the chair being taken by the Hon.-President, His Excellency the Governor General. The large audience included Lady Aberdeen and many distinguished persons, who greatly appreciated the President's able address upon " The Progress and Trend of Scientific Investigations in Canada," which gave a comprehensive survey of the work conducted by various departments of the government, and by the leading scientific societies. On the conclusion of the address His Excellency made some eulogistic remarks, and tendered to the learned lecturer the thanks of the audience. Many of those present then attended a delightful reception given by Mrs. Bourinot in her charming house on Cooper Street.

Wednesday was devoted entirely to the reading of papers in the sections ; an adjournment being made at 5 p.m., so that the members might attend an " At Home " given by Dr. Sandford Fleming. A very interesting public meeting was held in the evening by the French Literature Section : the programme including a lecture by the Hon. Mr. Marchand, M.L.A., of Quebec, entitled " Un Tour de France durant la Seconde République."

Thursday was made, in honour of Her Majesty the Queen, a day of rest and recreation. During the forenoon a large party visited the Central Experimental Farm, and were conducted over the grounds by the Director and his staff, who fully explained the many interesting experiments in progress in the several departments. A Luncheon and Garden Party at Government House, to the members and delegates, was given by Their Excellencies, whose delightful hospitality was greatly enjoyed. The society sent through His Excellency a cable message of congratulation to Her Majesty, Queen Victoria, to which a gracious reply was promptly transmitted.

Friday morning was occupied by the sections in completing their work and electing their officers, and in the afternoon a general meeting of the society was held, at which the reports of the sections were received, several Fellows elected, and various important matters discussed. The meeting was closed by the election of the following officers for the present year :—President, Mr. J. M. LeMoine, Quebec; Vice-President, Dr. Selwyn ; Hon.-Sec., Dr. Bourinot ; Hon.-Treas., Mr. Fletcher.

An eloquent and forcible lecture was delivered in the evening by Prof. B. E. Fernow, Chief of the Division of Forestry, U. S. Dept. of Agriculture, Washington, his subject being the "Battle of the forest." He graphically portrayed, first the long fight for the possession of the earth's surface and the formation of soil ; next the conflicts of the various species and the struggle for the most favorable habitats ; finally, the defeat by man, and the destruction of the more valuable forms. With axe and fire, not only the forest is removed, but often the very soil which it had taken so many ages to accumulate and prepare. The interest of the lecture was much enhanced by numerous beautiful illustrations. This address, read in conjunction with that of Prof. Macoun should impress upon all thoughtful persons the necessity for a more comprehensive and rational system of using our forests.

The success of this meeting of the society was contributed to by the following distinguished scientists from the United States, (who were present by invitation), Prof. O. C. Marsh, Dr. S. Scudder and Prof. B. E. Fernow. Rt. Hon. James Brice (London Eng.), Sir James Hector (Wellington, N. Z.), and Dr. S. H. Scudder (Washington U.S.), were

elected Corresponding Members, and the following gentlemen were elected Fellows :—Sec. I, Adolphe Poisson (Arthabaskaville) ; Sec. II, Wilfred W. Campbell (Ottawa), Arthur Harvey (Toronto), Dr. J. A. McCabe (Ottawa), Lt. Gov. J. C. Schultz (Winnipeg) ; Sec. III, Rev. Dr. Williamson (Kingston) ; Sec. IV, G. U. Hay (St. John N. B.), W. H. Harrington (Ottawa), and Rev. G. W. Taylor (Victoria B.C.). Wm. Kirby (Niagara), and Ewan McColl (Toronto), of Sec. II, were created Retired Members. Sections II and IV have now their full quota of members, there is one vacancy in Sec. I, and four in Sec. III.

Some sixty papers were read before the sections, many of which were extensive contributions to literature and science. In section III, a paper was read by Mr. Shutt, entitled "Some observations on the quality of the air of Ottawa," but the papers read in section IV were naturally of most interest to the members of the Ottawa Field-Naturalists' Club. Prof. Macoun's Presidential address was a very valuable paper on "The Forests of the Dominion and their Distribution." It is regretted that for want of space not even the titles of the other papers can be given. The Section elected the following officers for the current year : President, Mr. James Fletcher ; Vice-Pres., Prof. Wesley Mills ; Secretary, Prof. Penhallow. [Ed.]

BOOK NOTICES.

On Cyphornis, an Extinct Genius of Birds.—By E. D. Cope. Journal A. N. S. Philadelphia, Vol. IX, pp. 449—452, Plate XX.

To our knowledge of the extinct vertebrates of Canada, Prof. E. D. Cope contributes an interesting chapter in the last fascicle issued by the Journal of the Academy of Natural Sciences, Philadelphia. The paper is based on a specimen collected by Dr. George M. Dawson, from the Tertiary Shales of the west coast of Vancouver Island and belongs to the Geological Survey of Canada.

Elaborate descriptions and measurements of this specimen are given on pages 449 *et seq*, and it is said to consist of the "superior part of a tarsometatarse,' belonging to an extinct genus of bird. It was a rather singular but fortunate occurrence that this portion of the skeleton of this bird was preserved and discovered, inasmuch as "the tarso-

metatarse is perhaps the most characteristic part of the skeleton of a bird." Prof. Cope finds that this extinct species of bird, which used to inhabit our western coast in Tertiary times, and to which he has given the generic designation of Cyphornis, bears greater resemblance to the steganopodes or pelicans, than to any other family. "The anterior aspect of the bone," Cope says, (*loc. cit.* p. 451), "is almost exactly like that of Pelecanus, but the posterior aspect resembles that of none of the order in the absence of the tendinous groove." When compared with cretaceous birds, Prof. Cope finds but "one point of resemblance" and that with the extinct form *Hesperornis*, viz: in "the ridge-like elevation of the anterior part of the external tibial facet, which is in both genera connected with the intercondylar tuberosity." The affinities of this bird, Prof. Cope holds, "are more clearly with the Steganopodes,combined with affinities to more primitive birds, and having a simple hypotarsal structure." *Chyphornis magnus*, Cope, is the name ascribed to this extinct bird, which in Tertiary times--at a period probably intermediate between the Eocene and Oligocene—frequented the shores of Vancouver Island.

"As regards its habits, it may be said that the pneumatic character of its foot bone renders it improbable that it depended on this member for habitual locomotion on land. In all the birds of terrestial habit which I have examined," he continues, "and of which I can give information the tarsometatarse is either filled with cancellous tissue, dense or open, or the walls of the shaft are thick as in the Emu. The presumed affinity with the Steganopodes indicates natatory habits and probable capacity for flight. Should this power have been developed in *Cyphornis magnus*, it will have been much the largest bird of flight thus far known."

On plate XX, which accompanies the text of this fascicle, Prof. Cope figures four aspects of this bone and in the latter expresses the hope that additional material will be forthcoming from which to make more detailed and more perfect descriptions of this extinct bird.

H. M. Ami.

FAUNA OTTAWAENSIS.

Hemiptera.

By W. Hague Harrington, F.R.S.C.

Since the publication, in June 1892, of the list of Ottawa Hemiptera (Ottawa Naturalist, Vol. VI, page 25), the following additional species have been collected, and have been kindly identified by Mr. E. P. Van Duzee. Unless otherwise stated, only single specimens have been observed.

HETEROPTERA.

Corimelæna nitiduloides, *Wolff.* April 15th.

Euchistus ictericus, *Linn.* June 3rd 1893, Mer Bleue. May 25th and June 10th, 1894, Hull.

Phytocoris tibialis, *Reut.* Apparently common. July.

Neurocolpus nubilus, *Say.* July 29th.

Lygus pabulinus, *Linn.* July.

Diplodus socius, *Uhler.* July 30th. On Solidago, near Hull. This species is recorded from the Western States, and Mr. Van Duzee expresses his surprise at its occurrence at Ottawa. He asks "did it not come from British Columbia?" As it was captured not many hundred yards from the main line of the famous C.P.R, it may possibly have stolen a ride across the continent upon some train.

Limnotrechus marginatus, *Say.* Sept 3rd. Both sexes (and young apparently of same species) abundant in the canal. Probably the common species of all our waters.

Rhagovelia obesa, *Uhler.* Nov. 3rd. Both sexes abundant in Rideau River, above the railway bridge, near Hog's Back, in the small pools of the rapids.

HOMOPTERA.

Agallia sanguinolenta, *Prov.* June 26th.

Parabolocratus viridis, *Ulher.* This insect was erroneously given in the list as *Gypona quebecensis*, Prov., which is a synonym of *G. striata*, Burm.

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Deltocephalus inimicus, *Say*.

Athysanus extrusus, *Van Duzee*. June 17th.

Athysanus curtisii, *Fitch*.

Phlepsius incisus, *Van Duzee*. July 29th.

Phlepsius humidus, *Van Duzee*. July 31st. Aylmer.

Ulopa canadensis, *Van Duzee*. Common. This was referred to in previous list as *Ulopa n. sp.* It has since been described from specimens taken at Ottawa and Ridgeway, Ont. (Trans. Am. Ent. Soc. Vol. XIX, page 301). It is quite common in moss collected late in the fall and I have also taken it in the spring. No individuals have been observed with fully developed wings.

REPORT ON ORNITHOLOGY, 1893.

To the Council of the Ottawa Field-Naturalists' Club :

The Leaders in Ornithology beg to report as follows :—

The birds of this district have been under observation for so many years that any additions to the recorded list must almost of necessity be regarded as merely casual or accidental visitors. Of this character are the first two records which follow—

Brunnick's Murre, (Uria lomvia). A flock of 20 seen by Mr. G. R. White on the 20th of November on the Ottawa River near the city, out of which 5 were secured. They were identified by Mr. Robert Ridgeway of the U. S. National Museum. Reference has already been made to these in the "NATURALIST" for January 1894, p. 164.

Chewick, towhee, (Pipilo erythrophthalmus). One seen by Messrs. F. A. and A. P. Saunders 19th July, about 80 miles north of Ottawa near the Desert. This bird was certainly a long distance from its usual habitat, and the observers being without a gun at the time were unable to "collect" it ; but both of them are familiar with the species in western Ontario, and they are positive of the identification in this instance not only by sight but by call-note.

Holboell's Grebe, (Colymbus holboellii). There are but three previous records of this species here. On 6th September Dr. E. S. Wiggins shot one out of a flock of 5 or 6 on Shirley's Bay, Ottawa River.

Cowbird, (Molothrus ater). The report for 1891 recorded an instance of a pair of chipping sparrows, whose nest had been invaded by a cowbird in the usual fashion, but who succeeded in bringing their own young to maturity as well as the young cowbird.

The same observer, Miss Gertrude Harmer, in her notes for 1893, tells of a like case which came under her notice this year, and in which the result was equally fortunate. We are not aware of any other records similar to these, but it is possible that closer observation, on the part of those who may be fortunate enough to find nests containing eggs of the cowbird, might serve in some degree to relieve this species of the blame that has always attached to it, as a preventer of the hatching of the eggs of other birds.

An albino specimen of this species was observed this autumn near Shirley's Bay by Dr. McElhinney and Messrs. Robson and Thicke.

A number of minor observations in bird life, such as do not call for a place in this report, have been noted from time to time during the year in the Ottawa " NATURALIST," under the head of Notes on Ornithology.

The table of first and last appearances of migrants for 1893 has been prepared, but owing to the comparatively small number of records it has not been deemed advisable to publish it. It may, however, be referred to when required.

All of which is respectfully submitted.

A. G. KINGSTON.
Wm. A. D. LEES. } *Leaders.*
E. BOLTON.

NOTE.—The second excursion was held on Saturday, 23rd June, to Wakefield, and was a very successful and enjoyable trip, of which a fuller account will be given next month.—The several Sub Editors could contribute very greatly to the value and interest of the NATURALIST, and also lighten the work of the Editor, by sending in contributions more regularly. (Ed.)

(*Continued from page 60.*)

Nitroglycerine was found so difficult to handle that five years afterwards Noble invented dynamite, which is simply a sand soaked with nitroglycerine. Other absorbents for it have also been used, and the giant powder so much used in western mines is a mixture of common gunpowder and nitroglycerine. The new blasting gelatine is simply nitroglycerine in which 7 or 8 per cent. of gun cotton has been dissolved. Lithofracteur, dualine, colonia powder, fulminatine, sebastine, serranine, rackrock, atlas powder, vulcan powder, neptune powder, forcite, are all mixtures containing nitroglycerine. Hellhoffite, carbonite, roburite and kinetite have nitrobenzol for the explosive constituent. Mellinite consists essentially of picric acid. As for smokeless powders their name is legion and it would be useless to go into their composition. One of them, however, may be mentioned, namely cordite said to have been invented by Sir Frederick Abel and Professor Dewar. It is said to consist of nitroglycerine and gun cotton or some other nitrocellulose, and to have been adopted by the British Government for the army and navy.

(Experiments were here introduced ; the burning of gun cotton and of nitrocellulose.)

I have already indicated to you the percentage composition of the albumen of eggs, the casein of milk, and the fibrin of blood, and I might go on and characterise many other of the animal albumenoids which have been separated by chemists. This is, however, unnecessary for our present purpose and besides there have been detected in the examination of the animal fluids and tissues other albumenoids very difficult to classify under the headings which have so far been adopted by chemical physiologists. In fact ; products seem to have been discovered which indicate the existence of transitions or gradations betwixt those albumenoids which have already been accepted as pretty well defined compounds.

There exists, however, another set of albumenoids in the bodies of animals which it is impossible in a lecture on Nitrogen to pass over without notice. Beilstein calls them the Protein substances of the connective tissue. In English they are sometimes called the fibrous albumenoids and are a very curious class of substances. To it belong hair, wool, glue, etc., which in spite of their different characters are similar in composition.

Possibly these nitrogenous substances might be classed by themselves as colloids. They are possibly less hydrous than the proteids or albumenoids. This table exhibits their per centage composition.

	C.	H.	N.	S.	O.
Hair	49.7	6.4	17.1	5.0	21.8
Wool	50.6	7.0	17.7	?	
Feathers	51.9	7.2	17.8	?	
Skin (humansole)	50.3	6.8	17.2	?	
Oxhorn	50.7	6.7	16.2	?	
Glue	50.0	6.5	17.5	?	
Gelatine	50.0	6.7	18.3	?	

Formulae of the Colloids.

Gelatine	102.0	151.	31.		39
Chondrine	99.0	156.	40.		42
Keratine	230.5	381.	70.	6.	77

We learn from the characters of the colloids that some nitrogenous substances are very stable. Such are the compounds which constitute the horns and hoofs of animals, the latter constituting the raw materials for the manufacture of those important products used in the arts and called cyanides, ferrocyanides, sulphocyanides, &c. The first step in their production is the fusion of the substances rich in nitrogen with carbonate of potassa in iron vessels. Subsequent lixivation and crystallisation yield what was long known as yellow Prussiate. The essential constituent of these salts is the compound radical Cyanogen $C_2 N_2$ as it is also of the well-known pigment called Prussian Blue. In fact the history of these compounds begins with the production of Prussian Blue about 180 years ago. Equal parts of cream of Tartar, saltpetre and and ox-blood were heated together in order to produce the solution from which, by the use of green vitriol, the colour was precipitated.

Experiments.—Production of Prussian Blue. Decomposition of mercuric sulphocyanide.

Another very interesting set of nitrogenous substances are those which are formed in dead and decomposing animal matter. These are sometimes of a basic nature, are formed in the human corpse after

death, and have been called by Selmi, their discoverer, Corpse-alkaloids or Ptomaines. Some of these compounds are very poisonous, and Brieger calls them Toxines. To such substances are to be attributed the cases of sickness and death we frequently hear of from eating unsound meat and meat preparations. All decaying animal and vegetable matter produces substances dangerous to health in various ways, and among the most dangerous and disagreeable of these products are those resulting from the decomposition of the albumenoids.

But why is it that organic substances when left to themselves are so prone to decomposition ? We have seen that they can exist and pass through vegetable and animal organisms, nourishing and sustaining them, and exercising most beneficent influences in the economy of living organised bodies. Why is it that outside of these they behave in an altogether different and most dangerous fashion ? What is it that regulates and controls their chemical affinities for good when they form part and portion of an active living organism ? More than forty years ago Justus Von Liebig put forth a theory according to which the force which controls the affinities is the vital principle. This theory I have never seen any reason to abandon, and I shall try to state it in Liebig's own words.

" The production of organs, the co-operation of a system of organs, and their power not only to produce their component parts from the food presented to them, but to generate *themselves* in their original form and with all their properties, are characters belonging exclusively to organic life, and constitute a form of reproduction independent of chemical powers.

" The chemical forces are subject to the invisible cause by which this form is produced. Of the existence of this cause we are made aware only by the phenomena which it produces."

"The chemical forces are subordinate to this cause of life just as they are to electricity, heat, mechanical motion and friction."

" Such an influence, and no other, is exercised by the vital principle over the chemical forces."

" The vital principle opposes to the continual action of the atmosphere, moisture and temperature upon the organism, a resistance which is, up to a certain point, invincible. It is by the constant neutralisa-

tion and renewal of these external influences that life and motion are maintained."

(Agriculture and Physiology, pp. 389-90.)

When Liebig wrote thus he was perfectly well aware of the artificial production of urea by his fellow investigator, Woehler in 1828, and therefore could not have thought that that discovery was antagonistic to his theory of the influence of the vital principle. Gmelin, the author of the great hand-book of Chemistry, had in 1817 maintained that organic compounds cannot, like in-organic compounds, be artificially built up from their elements, and Berzelius also enforced this distinction, asserting that while in-organic bodies could, organic bodies could not be artificially produced. Woehler's discovery and others of a like nature since, have gone to prove that this was too sweeping an assumption. Many organic bodies have been produced artificially but by means and from substances altogether different from those employed in nature. Take the production of urea by Woehler. He obtained it by heating a solution of cyanale of ammonia. But that substance was produced, by decomposing the potash salt, and the latter from fusing yellow prussiale of potash and caustic potash with red lead. All of these substances are foreign to food and organic life and most of them are of a highly poisonous character. No wonder then that Liebig took no notice of such discoveries as invalidating in the slightest degree his contention that Life modifies and controls chemical affinities. He knew very well that chemists would never be able to produce an organic cell or a starch granule, and we know that, since his time every attempt to produce urea by the oxidation of the albumenoids has failed. And even although it should be found possible in the distant future, to fabricate, let us say, some grains of sugar in a roundabout way from strange artificial materials and with the help of complicated apparatus, would it be reasonable to consider that as equivalent to its production from the carbonic acid of the atmosphere in the tissues of the sugar cane? I trow not. Nevertheless we have chemical authorities of high reputation expressing themselves in the following way. "At the present day the belief in a special vital force has ceased to encumber scientific progress. We now know that the same laws of combination regulate the formation of chemical compounds both in animate and inanimate

nature. So soon as the constitution of any product of the organic world has been satisfactorily ascertained we look forward with confidence to its artificial preparation." Roscoe Schorlemmer, Vol. III, part 1, page 10. I confess to much impatience on reading such a statement. Talk of the arbitrary assumptions of ecclesiastical authority! There never was anything of that sort equal to this scientific popery. It is enough to justify the clergy of the present day in exclaiming "Quare fremuerunt gentes." "Why do the heathen so furiously rage together and why do the people imagine a vain thing?" And no wonder that some unbelievers in science feel justified in adding "He that dwelleth in heaven shall laugh them to scorn; the Lord shall have them in derision."

But apart altogether from the opinions of those among us who are of a religious turn of mind, I feel bound to maintain that such assertions as the one I have quoted from Roscoe Schorlemmer are not reasonable. To ignore the existence of life and the wonderful influence which it exerts on organic substances is not a scientific proceeding. And it appears to me to be still more unscientific to ignore the Author of life and of the unity and order of the universe. Is it reasonable, I ask, after having contemplated the myriads of miracles observable all around us, the wonderful intelligence and power displayed in nature, the astonishing phenomena and inexplicable results which are exhibited in every department of science, to stop short in our reasoning, shut up our mental vision and declare that we can know nothing of the Originator of all these marvels, because perhaps their complete explanation does not lie ready to our hands. To me the wonder is that men are forthcoming so trained or school bound as to be able to put fetters on their reasoning faculties just at this point. No doubt there are limits to the powers of the human intellect, but I do not see why we should stop short of these limits. They have been defined by Emmanuel Kant in his treatise on pure reason, but that did not prevent Liebig and others from thinking and writing of an unfathomable wisdom "The philosopher who has attained to the highest summit of moral wisdom, is he who, if he use his mind aright, has the clearest perception of the limits of human knowledge, and yet the most earnest desire for the lifting of the veil that separates him from the unseen.

So writes Carpenter the physiologist and further: "All our science is but the investigation of the mode or plan in which the Creator acts; the power which operates is infinite and therefore inscrutable to our limited comprehension." I am afraid that of late it has not been customary or very fashionable, in discoursing of the wonders of nature, to make much reference to the existence of a higher power than nature. In this I think we err greviously and I do not hesitate to range myself with those who believe it to be their duty, on such occasions as the present, to acknowledge with reverence the Creator and His wondrous works. I have no desire to depreciate the powers of the human intellect or disparage full and free investigation, but we should remember that to err is human in scientific as well as moral respects. As Schiller says: "Error leaves us never; but a high desire conducts the striving soul ever on towards the truth." Yes; "towards the truth," but possession of the whole truth can never be ours. Newton's ocean will always be spread out before us, and although here and there an adventurous ship may dredge in its depths and add slightly to the sum of our knowledge, still infinite space will remain for the labour of the investigators of countless human generations yet to come. Do not let us therefore become impatient or querulous or sceptical because we are not permitted to know everything. Let us acknowledge that we are woefully shortsighted at the best, and when in our reading or thinking or investigations we find ourselves face to face with wonderful and inscrutable phenomena let us stand silent in awe and reverence, or if we must attempt to explain the ways of the omniscient Author of the universe let us simply repeat what we are told in Scripture, that "He upholdeth all things by the word of His power."

SECOND GENERAL EXCURSION.

On Saturday afternoon, June 23rd, the members and friends of the club made their second excursion of the season, leaving by the 1 p.m. train for Wakefield and La Pêche.

Owing to several important events transpiring in Ottawa during the afternoon (notably a lacrosse fight) and the fact that many arrived at the station by electric car just too late to get on board, the party of excursionists was smaller than usual--about 70 being present.

Many of these, however, were among the most enthusiastic and indefatigable members of our society. Mr. R. B. Whyte, Mr. A. G. Kingston, Mr. Latchford, Dr. Ami, Dr. Bell, Col. White, Mr. Lambart, Mr. Whiteaves, Mr. Frank T. Shutt, Mr. R. A. Johnston, Mr. Glashan and many others of the "old reliables" were there and did all in their power to make the outing a pleasant and profitable one for their friends.

The afternoon proved to be cool, and all enjoyed the picturesque run up the Gatineau Valley. It is worthy of remark that though the club has has made so many excursions into this romantic district, there always appear to be new charms for the lover of Nature in this beautiful vale. On the arrival at Wakefield, the excursionists separated into parties, under the guidance of the several leaders. The writer was with those who went to the top of the mountain, from which there was a magnificent view of the valleys of the Gatineau and La Pêche. The climb was a steep one, but all felt amply repaid for the fatigue. After a rest on the summit and the collection of specimens of rocks and flowers and ferns—among the latter some lovely *Woodsia* were brought home—and not forgetting the insects (for there were several ardent entomologists with us), the descent was made to the valley of the Pêche, where, about 5 o'clock, all the parties assembled for refreshments, which by this time proved most acceptable.

Arriving at the station, addresses were given by the vice-president, Mr. Shutt, and by Mr. R. B. Whyte and Dr. Ami. These short talks by the leaders on the collections of the day—which were on this occasion by no means insignificant—and on the flora, fauna and geology of the district visited, are always of practical character and should prove not only an encouragement, but a great help to those who are endeavouring to learn somewhat of the manifold ways and phases of Nature.

Due notice of date and place of the August outing will be given, and it is hoped that all with whom it is possible will be present—thus assisting the council in the very best way to make the excursion a pleasant and successful one.—F. T. S.

OBITUARY.

The sudden death on Thursday, March 29th 1894, of Mr. Scott

Barlow, geographer and chief-draughtsman to the Geological Survey, makes another gap in the ranks of the associates of the first Director, inasmuch as the subject of this notice aided his father, the late Mr. Robert Barlow, in the compilation of the beautiful maps and sections in the Atlas to accompany the general report for 1863, and to illustrate the labor of Sir William Logan and his associates in the first twenty years of the life of the survey ; a monument to their memory which will not soon perish, and for which medals were awarded at the first Paris and London Exhibitions.

His death is a loss to the profession generally, and his familiar face will be missed by his many friends and especially by his colleagues, with whom he was on terms of the kindliest intimacy, and who all bear willing testimony to his high sense of honour and his devotion to duty. He leaves with them pleasant memories of his unfailing humour, generous, considerate forbearance and friendly counsel and assistance.

Mr. Barlow joined the Survey in November 1856, and had thus been more than thirty-seven years employed as surveyor, explorer and draughtsman. During the first years of his service he made important researches in conjunction with the late Mr. James Richardson, along the south shore of the St. Lawrence, and owing to his skill and pains-taking accuracy was engaged to work up the field-notes of Sir William Logan.

In 1870 he was employed in the Springhill coal-field in Nova Scotia. By digging and boring by hand along the outcrop of the coal-seams he ascertained their extension north and south so well, that the workings for the last fifteen years at that colliery have not passed beyond the ground proved by him. He was withdrawn from Nova Scotia in 1878, and after he succeeded his father as chief draughtsman, the duties of that office occupied most of his time, although he made surveys of certain mining districts in the valley of the Ottawa River.

He also made original surveys of the north and south shores of the Ottawa River for a radius of some twenty miles, with a view to preparing a complete geological map of Ottawa and its environs, to form the first of a series of geological maps of the larger cities and centres of Canada.

Mr. Barlow leaves a widow, daughter of John Crichton Esq.,

formerly manager of the Valleyfield paper mills, and a family of six children. He also leaves two brothers, John R. Barlow, Deputy City Surveyor, Montreal, and Mr. Alfred E. Barlow, M. A., F.G.S.A.

H. F. & H. M. A.

Ottawa, June, 1894.

REPORT OF THE ENTOMOLOGICAL BRANCH 1893.

To the Council of the Ottawa Field Naturalists Club:

The Leaders have much pleasure in reporting that the Branch is in a prosperous condition and that a satisfactory amount of work has been accomplished during the past season. Frequent excursions were held and as a consequence many species have been added to the local lists. The occurrence of some of the rarer species has already been recorded in the Ottawa NATURALIST under the head of Entomology. It is proposed for the future to continue this method of recording captures, instead of making an extended annual report.

The publication of the Fauna Ottawaensis has been continued by printing a complete list, with notes, of the Phytophagous Hymenoptera by Mr. Harrington. In addition to the above a complete list of the Butterflies of the locality with notes on their habits has been prepared by Mr. Fletcher and is ready for publication.

LEPIDOPTERA.—Good work has been done, particularly in breeding. Two additions have also been made during the past summer to the list of diurnals, viz: *Argynnis Triclaris* Hüb. a northern species, taken in Labrador, Hudson Bay and westward. Seven specimens of this rare insect were taken on June 13th and 14th in the Mer Bleue. *Thecla Augustus*, Kirby was also taken in the same place on the third day of the same month. Two specimens of *Exyra Rowlandiana* were bred from cocoons found in the pitchers of *Sarracenia purpurea*. These cocoons were at the extreme base of the leaves, beneath the mass of decomposing insect remains, and were white, closely-spun and elastic. The beautiful moth *Dryocampa rubicunda* is recorded as taken at Ottawa this year for the first time. In Western Ontario it is sometimes injurious to the maples grown as shade trees.

COLEOPTERA.--Several good additions have been made in this order. The more notable of which are the following: *Dicælus teter; Oodes fluvialis*, hybernating under moss at St. Louis Dam, with *Lachnocrepis parallelus; Donacia pubescens* taken in small numbers on bulrushes along the Rideau river early in June; *Toxotus vittiger*, twelve males of this handsome longicorn were taken at Casselman on June 13th; *Hypomolyx pinicola*, one specimen, and *Ditylus cœruleus*, two specimens, with numerous examples of *Tritoma humeralis* were taken on the same occasion. An interesting addition to the list was made in *Aphodius prodromus*, a European species recorded from the Northeastern States and as far west as Montreal, but not observed here until last spring when it was taken in some numbers at Ottawa and Caselman.

NEUROPTERA.—Very little has been done so far by members of the club in collecting and studying the true Neuroptera; but in the Pseudoneuroptera Mr. T. J. MacLaughlin has continued his collecting again this year. Last summer was particularly favourable for the insects of this family; no less than eight species were taken which had not been taken here before. Several specimens of the rare *Diplax costifera* were captured late in the summer, the first by Master Stephen MacLaughlin at the rear portion of the Powell property to the north of Bank street; others were taken later in the same locality and at the Experimental Farm. Previously only one specimen had been taken, in 1886. This species resembles the female of *Diplax rubicundula*, the most apparent difference is that the anterior margins of the wings of *costifera* are conspicuously shaded with a yellowish brown tint.

HEMIPTERA.—Several additions have been made to the list published in June, 1892. These will be submitted for publication later, when some unidentified species have been determined. *Pœcilocapsus lineatus* and *Lygus pratensis* were noticeable from their abundance and injuries in gardens. An important discovery has been made by Mr. Slingerland, of Ithaca, that the former of these hybernates in the egg state in the twigs of bushes. This knowledge indicates judicious pruning as a means of checking the increase of this pest.

HYMENOPTERA.—A list of the phytophagous species observed during the season was published last January. The only species noticed as unusually abundant were the Ash Saw-fly, *Monophadnus bardus*, Say;

the Cedar Saw-fly, *Monoctenus fulvus*, Norton, which was taken in some numbers on an ornamental cedars on the Experimental Farm at the end of May, and the Cornel Saw-fly, *Harpiphorus tarsatus*, Say, also at the Experimental Farm where it attacked chiefly *Cornus siberica.* It may be mentioned that of a brood of the Rose Saw-fly, *Cladius pectinicornis*, of which the larvæ were collected in the autumn of 1892, it was found that, when the flies emerged last spring, there were just as many males as females, although in collecting the males are very rarely taken. In other sections of the order the species have not been so fully worked up as to justify the immediate publication of lists. Of the family Proctotrypidæ, however, our knowledge has been enormously increased by the publication of Mr. Ashmead's magnificent monograph, in which seventy species collected in this locality are mentioned, of which no less than fifty were new to science. Mr. Ashmead is now engaged on a monograph of the Braconidæ, and a series of our species has been placed in his hands for study.

Diptera.—In this order two observations of special interest are worth recording. (1) The root-maggot of the cabbage, *Anthomyia brassicæ* was very abundant, but was found to be much infested by two true parasites, *Aleochara anthomyiæ*, Sprague, and an undescribed insect to be called *Eucoila anthomyiæ*, Fletcher, both of which were bred from puparia collected last autumn. (2) The now notorious Horn-fly, *Hæmatobia serrata*, B. D., which made its first appearance in Canada last year at Oshawa, has now spread over the whole of the central portion of the Dominion from Essex, in the west of Ontario, to New Brunswick.

Collections.—In addition to the fine collection of insects in the museum of the Geological Survey, we are glad to record that the collection specially prepared for the World's Fair is now on exhibition in museum of the Experimental Farm. This consists of twenty cases of Lepidoptera, Hymenoptera and Coleoptera, and forms the nucleus of what will be a most important exhibit.

Among the active members of the Branch mention should be made of Mr. W. Simpson who has done some good work. He has collected chiefly at King's Mere, in the Chelsea Mountains, where he has taken many of our rarer insects. He has also brought to our notice three in-

teresting monstrosities discovered by him in examining his coleoptera, in each of which the right antenna is curiously malformed. The species are *Dytiscus Harrisii*, *Desmocerus palliatus* and *Adimonia cavicollis*.

MOSS-SIFTING.—We would specially call the attention of our entomologists to the value of the method of collecting moss late in the autumn for examination during the winter. This consists simply of tearing the moss to shreds and shaking it through a sieve over a sheet of white paper, when large quantities of small species, otherwise seldom found, can be collected. As an instance of what may be done in this line, two small cotton bags were filled with moss early in November, which, when carefully examined, yielded over one hundred species of insects in different orders. This method also gives valuable information regarding the species which hybernate in the perfect state. The bags should be kept slightly frozen, but not exposed to excessive cold, as 20° below zero has been found to kill everything in a bag.

J. FLETCHER,
W. H. HARRINGTON, } *Leaders.*
T. J. MacLAUGHLIN,

ENTOMOLOGICAL NOTES.

During July many of the grasshoppers and other members of the order Orthoptera become fully grown, and as their numbers increase they do marked damage to vegetation. In the adult state the majority of the species possess fully developed wings, and can thus move more rapidly to new feeding grounds. There are however, wingless forms and of these a very interesting species is now abundant, although perhaps many of our members may not observe it. This insect is commonly known as the "Walking Stick," a name which its appearance easily gains for it, while entomologists have named it *Diapheromera femorata*. When young the "Walking Sticks" are pale green and not easily discerned on the young foliage of the trees, hickory and oak, upon which they feed. They grow brownish with age, and attain a length of about three inches, the female being stouter and less active than the male. The legs and autennæ are very long and slender and the whole structure of the insect tends to disguise it and to prevent its enemies from detecting it as long as it remains upon its food plants. A charming article by Dr. Scudder on this group of insects, with beautiful illustrations, appeared in a recent number of Harper's Magazine.

W. H. H.

CLIFF ON MOUNTAIN HILL, QUEBEC CITY,

Shewing masses of fossiliferous limestone imbedded in contorted shales.

(To illustrate Mr. Weston's and Dr. Ami's paper.)

British American Bank Note Co., Montreal

MARINE BIOLOGICAL LABORATORY LIBRARY WOODS HOLE, MASS.

NOTES ON THE "QUEBEC GROUP."

By T. C. Weston, Esq., F.G.S.A., of the Geological Survey of Canada.

Out of the 12,000 feet or more of strata which form the much discussed "Quebec Group," there are several interesting escarpments and sections which have hitherto not received the attention they deserve. One of these escarpments is the Mountain Hill cliff, * which forms a portion of the heights over which the ramparts of the City of Quebec are built.

The only reference I can find, at the present time, to this special locality, is Dr. Ami's paper on "the Geology of Quebec and environs," published in the "Bulletin of the Geological Society of America," Vol. II., pp. 477–502, 1891, from which I quote the following. "Alongside and up the Mountain street, a bold cliff of conglomerate occurs, containing large boulders, imbedded in a shaly and calcareo-argillaceous paste, with an admixture of quartz grains. This deposit, as well as most of the exposures in Quebec city, deserves very special attention, and will no doubt afford interesting notes and material."

A close examination of the cliff immediately facing Mountain Hill House, on the lower part of the hill, shows it to be composed of a coarse grey nodular limestone; in places, bedded structure may be seen, while the principal portion, (which is the matrix of the conglomerate), is compact, and sometimes flinty, with seams of carbonaceous or bituminous matter.

This portion of the cliff is prolific in fossils, but they are chiefly fragmentary, and might readily be overlooked. This is probably the reason why in the early study of the geologic structure of the city portion of the 'Quebec Group,' these were included in the Levis division of the same.

No fossil remains had been found or observed in the Mountain Hill cliff until the summer of 1877, at which time the writer discovered a number of interesting species. In 1892, another opportunity was afforded me to examine that portion of the exposure immediately back of the Express office and adjoining the book-binding establishment. On that occasion there were found some remarkably well-preserved fossils,

*See Plate accompanying this and next paper.

some of which were immediately recognized as being characteristic Trenton forms. Dr. Selwyn arriving in the city at that time, accompanied me to this locality, and several new species were added to our former collection.

In conjunction with this paper will be found a list of the genera and species of fossil remains determined by Dr. H M. Ami, of the Survey. It will be readily seen from the lists prepared that a good proportion of them are common Trenton forms—a gratifying circumstance to the Director of the Geological Survey of Canada—Dr. Selwyn—who was the first to recognize the Quebec city rocks as a portion of the Trenton zone, and not *Levis*, as originally supposed.

However, as the formation under consideration contains large boulders of dolomitic limestone, which were evidently derived from the Levis limestone conglomerates, in which we may find Levis fossils in the shaly portion of the cliff, as in the shales and limestones at the back of the St. John street (Montcalm) market, we must not take the whole as typical Trenton, but as a mixture of Trenton, Utica, and Hudson River.

Quebec City, Que., May, 1894.

NOTES ON FOSSILS FROM QUEBEC CITY, CANADA.

By Henry M. Ami, M.A., F.G.S., &c.

The environs of Quebec city have long been regarded as classic ground to the student of North America Geology.

From the numerous rock-formations around the city, some of the most interesting and important specimens were obtained by various members of the Geological Survey staff, under the '*old régime*' and under the present administration.

The faunas entombed in the rocks of the so-called 'Quebec Group' at Point Levis and elsewhere, have been described by Billings, Hall, and other palæontologists. Strange to say, however, for some reason that cannot be accounted for, the sedimentary rocks forming the Citadel Hill and massif of Quebec city, remained for a very long time a *terra incognita*. It is only during recent years, that the veil has been

drawn away from these obscure and difficult portions of the region in question through the researches of Mr. T. C. Weston, F.G.S.A., of our Geological Survey. It was in 1877, that, for the first time, Mr. Weston discovered fossil remains in the strata of Quebec city, and amongst the specimens collected on that occasion there were noted the obscure remains of *Leptæna sericea*, Sowerby, and of a species of *Ampyx*, closely related to *Ampyx rostratus*, together with crinoidal fragments. These came from the limestone rocks of Mountain Hill.

The purpose of this paper is mainly to note the interesting discovery of fossils made this summer by Mr. Weston, in the rocks of Mountain Hill, of which Mr. Weston gives a description in the foregoing pages of the NATURALIST. There is added to the notes on the fossil remains collected this season, a few more on the small but likewise important collection made by Mr. Weston and Dr. Selwyn in 1892. The determinations are of course preliminary and dependent upon the mode of preservation, etc.

MOUNTAIN HILL FOSSILS.

Inasmuch as the collections of 1892 and 1894 were both made by Mr. Weston—and at the very same locality, there is no practical reason for keeping them separate at this time, and for the sake of brevity they will all be grouped together under the heading of Mountain Hill fossils, Quebec City. The collections comprise in all about 125 specimens and embrace an assemblage of forms which are for the most part new to the massif of Quebec city, whilst not a few are probably new to Canada.

PRELIMINARY NOTES ON THE FOSSILS.

PROTOZOA.

1. *Nidulites favus*, Salter, var. A rather crushed and imperfectly preserved specimen of what appears to be a variety of Salter's species, *Nidulites favus*, a Rhizopod with marked affinities for such genera as *Pasceolus*, Billings; *Sphærospongia*, Salter, and *Cyclocrinus*, Eichwald. The hexagonal character of the "plates," the presence of the 'central papilla' or styliform projection in the central portion of the plate are

features which the Quebec specimen shows distinctly. The main difference is of size. The plates in the Canadian example of *Nidulites*, are considerably smaller than those in the type of Salter's species from Europe* : there being ten plates in the space of one centimetre in the former and six plates in the same space in the latter. This species has not heretofore been recorded in Canada, and forms an interesting addition to our fauna.

Note. The occurrence of this species along with many of its associates also points to the close relation which probably exists between the rock formations of the Girvan succession in Scotland, and those of the fossilferous 'Quebec group' in Canada, a correlation which had already been made apparent to the writer on account of the similarity of the faunas.

Cœlenterata.

2. *Streptelasma corniculum*, Hall. A small and rather obscure turbinate coral occurs in the collection. From its characters and affinities it appears to be closely related to the ordinary Trenton form described by Hall from the New York series. The Quebec specimen is here referred to in this species with some uncertainty.

3. *Diplograptus*, cf *D. rugosus*, Lapw. Among the specimens collected on Mountain Hill only one graptolite occurs, and that appears to be a diplograptid, allied to Prof. Lapworth's *D. rugosus*. It is not well preserved, and the hydrothecæ are somewhat irregular and recall *D. amplexicaulis* of the Trenton.

Bryozoa.

4. *Pachydictya acuta ?* Hall. A number of broken and more or less imperfectly preserved stipes of this species occur on the weathered surfaces of the limestone. *Note.* Besides the above species of Polyzoa (Bryozoa)—doubtfully referred to *P. acuta*, Hall, there are several fragments of branching Bryozoa which require to be examined microscopically in thin sections before they can be determined with any degree of accuracy. From a mere superficial examination of the zoœcial aper-

*See Nicholson and Etheridge, Jr., "A Monograph of the Silurian fossils of the Girvan District in Ayrshire, I., p. 18, 1874."

tures and characters of the polyzoary, the following genera appear to be represented :—*Monotrypella*, *Batostoma*, *Homotrypa*, etc., forms similar to those from the Trenton rocks of Canada and elsewhere.

Brachiopoda.

5. *Acrotheta* sp. A small but interesting specimen of this genus occurs in the collection, but its specific relations are not yet definitely ascertained.

6. *Acrotheta* sp. indt.

7. *Discina* or *Lingula*, sp. indt.

8. *Schizotreta* cf. *S. minutula*, Winchell and Schuchert. Two valves, one a brachial and the other a pedicle-valve of this interesting genus, occur associated with numerous other species of brachiopoda. They closely resemble the above species to which they are referred with some doubt whilst they also indicate close relation to *Discina Pelopea*, Billings, a true species of *Schizotreta*.

9. *Paterula*, sp. nov. An interesting form of this genus rare in America was collected in the limestones at Mountain Hill, Quebec. In general outline and leading characters it resembles closely *P. Bohemica*, Barrande, but is probably distinct. This species is certainly distinct from another species discovered by Mr. Weston in the rocks adjoining the Montcalm market, Quebec, and figured by Hall in his Vol. VIII. of Pal. N. Y. State, on Brachiopoda. This species of *Paterula* very closely resembles a form collected by Prof. L. W. Bailey in the black limestones of the Becaguimic Valley, in New Brunswick, in 1884, but is much smaller, being only one millimetre in length.

10. *Lingula Nympha*, Billings. A rather large individual of what appears to be a species identical with the above which was originally described from Newfoundland. The septum, central scars and other characters of generic importance are clearly visible, and the general outline of the shell make it very probable that this "Quebec Group" species occurs at Quebec also. With this species compare *L. Elderi*, Winchell and Schuchert.

11. *Lingula*, sp. Resembles one of the forms from the "market rocks" of Quebec—probably "species No. 1" of my appendix to Dr.

Ells's report for 1888, published in 1889. This species also resembles one from the limestones of the Beccaguimic, N.B., collected by Dr. Bailey.

12. *Lingulepis*, sp. With exceedingly fine radiating striæ. Shell: ovate, elliptical, anterior margin rounded; greatest breadth at about three-fourths distance from beak to anterior margin. Beak rather prominently pointed.

13. *Leptæna (Plectambonites) sericea*, Sowerby, sp. Two or three typical examples of this characteristic Trenton species occur in the collection from Mountain Hill. One form resembles the Hudson River or Lorraine variety, being large and quadrangular.

14. *Leptæna* (*Plectambonites*) sp. A diminutive form of Leptæna closely resembling *L. sericea*, but probably distinct also occurs in the collection.

15 *Strophomena Aurora*, Billings.

16. *Strophomena* (*Rafinesquina*) *alternata*, (Conrad, MS.) Emmons.

17. *Strophomena* (*Rafinesquina*), sp. nov.

18. Strophomena or Leptænoid shell, similar to the form occurring at the Montcalm market exposures. Probably new generic type.

19. *Orthis* (*Dalmanella*) *testudinaria*, Dalman.

20. *Orthis* (Plectorthis) *plicatella*, Hall. Probably the above species. The specimen is not sufficiently well preserved to state definitely. May be Orthis (Dinorthis) pectinella, Conrad.

21. *Orthambonites?* sp.

22. *Camerella* or *Anastrophia*, *sp.*

Gasteropoda.

23. *Metoptoma*, sp. There appear to be two forms of this genus in the collection from Mountain Hill, one a comparatively large form the other much smaller. The smaller ones shows concentric zones. Beak in both eccentric pointing anteriorly.

24. *Murchisonia?* sp.

Cirripedia.

25. *Turrilepas*, sp. nov. Several specimens of a species of Tur-

rilepas occur in both the 1892 and 1894 collections. This species is identical with another found in a lot of Newfoundland fossils, labelled "Port-aux-Choix," and collected by Mr. Richardson. The species is very closely related to one of the forms described by Nicholson and Etheridge from the Girvan district (*loc. cit. ante.*)

ENTOMOSTRACA.

26. *Primitia* sp. No. 1.
27. " sp. No. 2.
28. *Isochilina* sp. indt.

TRILOBITA.

29. *Ampyx*, cf. *A. normalis*, Bill., or its near ally. *A. rostratus*, Sars. The latter species occurs in the rocks of the Girvan succession, and this is abundant in the rocks of Mountain Hill. It was collected in 1877, in 1892 and 1894.

30. *Amphion ?* sp. indt. An imperfectly preserved or obscure pygidium of a trilobite, which is most probably referable to this genus.

31. *Bathyurus*, sp. No. 1.

32. " sp. No. 2.

33. *Dolichometopus ?* sp. or *Symphysurus*, sp.

34. *Remopleurides*, sp. No. 1. Apparently new. Differs somewhat from *D. Schlothimi*, Billings, and from *D. Canadensis* and *D. affinis*, already described from Canadian rocks. It belongs to the typical or smooth form, of which the last two mentioned are types.

The Mountain Hill specimens, which are tolerably abundant, are not unlike in general outline to *Remopleurides Barrandii*, Nicholson and Etheridge Jr., good specimens of the cephalon of this species occur in both the 1892 and 1894 collections.

35. *Remopleurides*, sp. No. 2. Smaller form.

36. *Dalmanites callicephalus ?* Green.

37. *Calymene senaria*, Conrad. (= C. tuberculata, of European authors, also *C, Blumenbachii*.)

38. *Asaphus canalis*, Conrad.

39. *Asaphus*, sp. cf. *A. megistos*, Locke.

40. *Ceraurus pleurexanthemus*, Green.

41. *Phacops Brongniarti*, Portlock, or a very closely related species.

42. *Microdiscus ??* sp. indt., or *gen. nov.* A very diminutive form of trilobite occurs with *Nidulites favus ?* Salter, and *Remopleurides* sp. No. 1. It is more closely related to the genus Microdiscus.

43. *Trinucleus concentricus*, Eaton. Very fine and numerous examples of this typical Trenton species occur in Mr. Weston's collection. These are precisely like those which occur at Montmorency Falls, above the Falls, near Quebec.

44. *Trinucleus*, sp. indt. A much smaller but prolific form of this genus occurs with many of the foregoing species. It differs from the other chiefly in size, in being strongly tuberculated and in other subordinate characters. Head and pygidium *four* millimetres and scarcely *four*, respectively.

45. *Illænus*, sp.

Note.

(*a.*) Besides the above there appear to be indications of the presence of such forms as *Agnostus*, *Staurocephalus*, *Dicranopora*, and numerous fragments of crinoidal and cystidean remains.

(*b.*) It may not be uninteresting here to note the discovery made by Mr. Weston this summer, in the rocks on Valier street, Quebec city viz. a portion of a large crinoidal column *eight* millimetres in diameter. A length of 7.5 mm. of the column is preserved.

This specimen strongly resembles similar crinoidal fragments sent to Mr. Whiteaves, of the Geological Survey, in 1882, and belonging to the "Wappinger limestone" of the vicinity of Poughkeepsie, N.Y.

(*c.*) It will thus be seen, that so far, from the interesting collections made by Mr. Weston in 1877, 1892 and 1894, respectively, we have no less than *forty-five* species of fossil remains. These will, no doubt, be supplemented by new and in such cases, probably better specimens, so that this preliminary report will probably be superseded before very long. A great deal of credit is due Mr. Weston for his perseverance in the work he has accomplished, and the present paper brought out in connection with the announcement of this discovery by

Mr. Weston, is prepared in the hope that it will help to throw some light upon a district which, although in the midst of a large and growing population, is still almost entirely unknown and unwritten.

(*d.*) The following is a recapitulation of the species included in the paper :

Rhizopoda.

1. Nidulites favus ? Salter.

Cœlenterata.

2. Streptelasma corniculum, Hall.
3. Diplograptus, cf. D. rugosus, Lapworth.

Bryozoa.

4. Pachydictya acuta ? Hall.

Brachiopoda.

5. Acrotheta, sp.
6. Acrotheta, sp. indt.
7. Discina or Lingula, sp.
8. Schizotreta cf. S. minutula, W. and S.
9. Paterula, sp. nov. cf. P. Bohemica, B.
10. Lingula Nympha, Billings.
11. Lingula, sp.
12. Lingulepis, sp.
13. Leptæna (Plectambonites) sericea, Sow.
14. Leptæna, sp.
15. Strophomena Aurora, Bill.
16. Strophomena (Rafinesquina) alternata, Emmons.
17. " " sp. nov.
18. Strophomena or Leptæna ?
19. Orthis (Dalmanella) testudinaria, Dalm.
20. " (Plectorthis) plicatella ? Hall.
21. Orthambonites ? sp.
22. Camerella or Anastrophia, sp.

Gasteropoda.

23. Metoptoma, sp.
24. Murchisonia ? sp.

Cirripedia.

25. Turrilepas, N. sp.

Entomostraca.

26. Primitia, sp. No. 1.
27. " sp. No. 2.

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28. Isochilina, sp. indt.

Trilobita.

29. Ampyx, cf. A. normalis, Bill., and A. rostratus, Sars.
30. Amphion? sp. indt.
31. Bathyurus, sp. No. 1.
32. " sp. No. 2.
33. Dolichometopus? sp., or Symphysurus, sp.
34. Remopleurides, sp. No. 1. (n. sp.)
35. " sp. No. 2. (n. sp.)
36. Dalmanites callicephalus? Green.
37. Calymene tuberculata, (=C. senaria), Conrad.
38. Asaphus canalis, Conrad.
39. " sp. cf. A. megistos, Locke.
40. Ceraurus pleurexanthemus, Green.
41. Phacops Brongniarti, Portlock.
42. Microdiscus?? sp. indt.
43. Trinucleus concentricus, Eaton.
44. Trinucleus sp. indt probably n. sp.
45. Illænus, sp.

Ottawa, August, 1894.

SUGAR AND ITS MANUFACTURE.

By Adolf Lehmann, B.S.A., late Asst. Chemist, Dominion Experimental Farms.

The manufacture of sugar is an art which, like many others, has come to us from the far East. Its beginning is somewhat obscure, but probably it was first carried on, in a primitive and very limited way, by some of the tribes or nations of India. It has since, with the successive strides of civilization, assumed greater and grander dimensions. The Persians, Arabians and Spaniards, have in their turn been improving and extending cane-sugar manufacture. Other nations, notably the English, and in former days the Italians, especially the Venetians, have materially assisted in this work.

In Persia, the industry was relatively at its height during the eleventh century. At this time the product was especially prized as a medicine; in fact it was manufactured for this purpose until the extended use of tea and coffee made its use more universal. Shortly after the discovery of America, the industry was planted in the West Indies. Soon these islands began to supply the principal portion of

this commodity, a position they retained for centuries. But during the past thirty or forty years, cane sugar has found a strong competitor in beet sugar. Now, Germany stands at the head of the sugar producing nations, and the beet furnishes the principal portion of the sugar on the market. This position has not been attained through the superiority of the beet as a sugar producing plant--for it is more difficult to manufacture sugar from it than from the cane—but through the energy, perseverance, and almost endless work of men of science.

In 1747, Marggraf, a German chemist, the director of the Academy of Science at Berlin, discovered sugar in different members of the beet family. His pupil and successor, Karl Achard, built in 1799 the first beet sugar factory near Berlin. He spent a fortune and a large portion of his time in developing the industry, and he may be said to be the father of it. Shortly before Achard's death, Napoleon I. placed such restrictions on the importation of sugar into the continent of Europe that at one time it reached the price of about 75 cents a pound. In addition to this import tax he compelled farmers to plant a definite area with sugar beets, and in other ways assisted the beet sugar industry. It flourished for a time, but appeared to be almost dead, especially in Germany, after these favourable legislations were removed. However, improved methods of manufacture and a careful attention to the cultivation of the beet, together with reduced prices in other farm crops, have made it an industry which, instead of receiving a bounty, pays a handsome revenue to the state in the form of an excise duty.

It is largely to the promoters of the beet sugar industry that we are indebted for the great reduction in the price of sugar. They have placed it within the reach of all, and transformed the luxury of yesterday into the necessity of life of to-day. They have also revolutionized the cane sugar industry—an industry which, although perhaps a hundred times as old as its young rival, still looks to it for instruction.

The plant from which sugar was almost exclusively made till the introduction of the sugar beet is the sugar cane, *Saccharum officinarum*. It is a plant which in appearance is not unlike Indian corn. The stalk is from one to two inches in diameter at its base, and generally from five to eight feet in height, although occasionally, especially in the more southern countries, it reaches fully double that length. The colour varies

from a greenish yellow and a yellowish green to a deep purple, depending upon the variety. Some varieties are striped, others are uniform in colour. The leaves are somewhat narrower, but otherwise resemble those of Indian corn. In Louisiana, the seed never ripens, in fact the flowers are never seen. In more southern latitudes where its growth is not interfered with by frost, it matures in about 18 months. It is a perennial. Its seeds are small and its flowers form an open panicle.

On the North American continent, Louisiana has ever held the position of the sugar manufacturing centre. The centennial of the first manufacture of sugar was celebrated at the sugar experimental station of Louisiana on June 30th, 1894. The southern half of the State is almost exclusively devoted to this industry, and but little cane is grown north of this. The sugar cane is propagated by a modified form of cuttings. The stalks, or sometimes portions of them, are laid in a horizontal position, generally two along side of each other, in furrows from four to eight inches deep and covered with finely pulverized earth. These stalks serve the same purpose as the planted potato. The buds develop into the new plants and the stalks serve to supply nutrition to them till they are able to draw food from the soil. The rows of cane are generally about five or six feet apart, formerly they were from three to five feet. In the rows the plants appear about every six to twelve inches ; but, as the season advances, these multiply by stooling, tillering, or suckering, in direct proportion to the fertility of the soil. With favourable conditions an acre will produce upwards of 30 tons of cane, and each ton gives 175 to 200 lbs. of sugar.

In Louisiana, where frost that injures the cane, frequently occurs in the latter part of December, harvesting is generally begun about the middle of October, and continued for two or three months. The cane is cut by hand with very wide thin-bladed knives about 18 inches long. The leaves and top of the cane are removed at the same time and the and the stalks conveyed by carts, or on the larger plantations, by cars to the sheds of the factory. Here it must not be allowed to accumulate too much ; for, like sorghum (and other plants from which sugar is occasionally made), cane deteriorates soon after it is cut. At present, the majority of planters have their own sugar houses. These are, however, gradually being replaced by central factories, and in the course

of time the manufacturing of sugar and the growing of cane may become separated, like the producing of milk and the making of cheese have become in Ontario.

As in other plants, the sugar of the cane is found dissolved in the juice. In Louisiana, this juice contains about 9%–14% of sugar, sucrose, 1% to 2% glucose, and about an equal quantity of other solids. Two methods are at present used, on a large scale, to extract the juice. The one most generally employed for cane is that of pressing it out by passing the stalks as they come from the field between large iron rollers which almost touch each other. These rollers are frequently almost three feet in diameter, and six to seven feet long, and five, six, or even nine of them are placed in successive sets of three near each other. In the case of a five roller mill, the front set has three rollers and the one behind the remaining two. The stalks of cane in passing through these successive sets of rollers are, of course, pressed twice in each set of three; for two rollers are lying side by side at the bottom and the third is placed above and between these, in such a position that it almost touches the second one of the lower rollers but allows a little more space to be between it and the first of the lower rollers. This enables the cane to pass easily into the mill and to be at the same time thoroughly pressed. In order to make the extraction of the sugar from the cane as complete as possible, the cane is generally moistened with water while passing from one set of rollers to the next. When the stalks leave the mill they are practically dry and torn into comparatively small pieces, and present a somewhat spongy appearance. They are now largely used as fuel under the boilers of the sugar houses. The other method for extracting the sugar from the cane is called the diffusion process. It is the method almost exclusively employed in obtaining the sugar from beets. In it the cane is first cut transversely into pieces not more than an inch long, subsequently sliced, or shredded longitudinaly as fine as possible, and packed tightly into a battery of iron cylinders or cells all connected with each other by pipes. Water is pressed into the first cell and from it to each succeeding one, remaining about ten minutes in each. Fresh water is passed through in this way several times, or until the chips in the first cell are practically free from sugar. These chips are then thrown out. After the cell has been refilled with fresh chips of sugar

cane it becomes the last instead of the first of the chain. All the cells are successively treated in like manner. Thus as little water as possible is used to dissolve out the sugar–a very important factor, since all the water will have to be evaporated off. This so-called diffusion juice contains approximately two thirds the percentage of sugar found in the mill juice of the same cane ; or in other words, two thirds of the "diffusion juice" may be considered as pure juice and the remaining third as water added to it.

The juice, no matter how obtained, contains in addition to water and sugar, a considerable portion of other compounds. Among these are albuminoids, amides, colouring matter, organic acids, gums and mucilages. All these have to be removed as much as possible before the evaporation of the water is begun. Frequently sulphur dioxide, produced by burning sulphur, is first used as a bleaching agent ; but unless it is decided to produce the highest grades of sugar directly at the sugar house, the advisability of its use may be somewhat questionable, since it has a tendency to reduce the sugar yield. Lime is invariably used as a clarifying agent, either alone or directly after the use of sulphur dioxide. It is generally added, suspended in water, to the juice, in large iron tanks—generally enough to make the juice slightly alkaline. The mass is slightly boiled and the skum removed from the top several times, or rather just as the scum forms The precipitate is allowed to settle and the clear liquid drawn off. A further clarification and the removal of any excess of lime by the use of phosphoric acid will probably be adopted in the near future. The skimmings and setlings are pressed through heavy canvas filters, and the liquid separated from them, which of course contains a considerable percentage of sugar, is added to the other portion of clarified juice, which is now ready to be boiled into sugar. The solid portion is thrown away or used as a fertilizer.

The evaporation of the juice is generally carried on in two stages. The first, to near the point of saturation ; and the second to such a consistency that it will still run readily out of the vessel in which it has been boiled. Both these concentrations are almost invariably conducted in a partial vacuum. The vacuum is increased with the concentration of the juice. The initial evaporation is generally done in two or three separate vessels, the steam of the first being used to heat the

second and that of the second to heat the third. The final concentration is accomplished in a large iron vessel containing seldom less than five to six tons of sugar, or rather of a mixture of molasses and sugar, when the boiling is completed.

The molasses is separated by centrifugal force from the crystals c sugar suspended in it. In making the finer grades of sugar, the molasses still clinging to the sugar crystals is washed off either with steam or by the use of water. If a weak solution of stannous chloride is used in place of the water a sugar having a rich amber colour (Demarara sugar) is obtained. By great care in the manufacture and a liberal use of water in the centrifugal it is possible to make a sugar directly from the juice.

This sugar would be difficult, if not impossible, to distinguish from a product refined with animal charcoal. To get rid of the water still clinging to the crystals, the sugar is dried in a slightly inclined, horizontal, heated, rotating cylinder called a granulator. The sugar is called granulated and contains over 99% of sucrose. However, comparatively little sugar is made of this grade in the sugar houses, there being considerable loss by washing in the centrifugal. The greater portion is sold to the refiners. Here it is redissolved, filtered through animal charcoal and again boiled into sugar.

To produce a good quality of sugar, it is necessary to have the crystals of uniform size and as large as they can conveniently be made. Small crystals are liable to choke the sieve of the centrifugal, and prevent the easy and perfect separation of the molasses from the sugar, and this of course reduces the quality. The preliminary evaporation to near the point of saturation, gives the sugar maker a more perfect control of the crystallization. The process is briefly as follows : The pan in which the boiling is done is partially filled with the already concentrated juice, called syrup. This is boiled down till the crystallization has just begun. A small quantity of additional syrup is then drawn in. Thus by very slightly diluting the boiling mass the tendency to prevent any further crystals from forming is brought about. The amount of syrup added from time to time must be enough to do this but not so much as to redissolve the crystals already formed. The evaporation going on all the time, and no new crystals being allowed to form, those already there must increase in size, and that uniformly. The smaller the number of crystals relative to the size of the pan, the larger they can be made to grow.

The sugar obtained from the sugar beet, the sugar cane, the maple and the sorghum, differs only in the kind and quantity of impurities it contains. The pure sugar from all of these sources is identical. It is commonly called cane sugar, *sucrose*, the name being derived from the plant from which it was in the past principally made. In addition to sucrose, several other, however, less important kinds of sugar are on the market. The two principal of these are *dextrose* and *lævulose*, sugars resembling each other in many respects. The former is now extensively made from Indian corn by transforming the starch in it with dilute sulphuric acid and neutralizing the excess of acid with lime. It is largely used in compounding the various mixtures sold as syrup on the market—few of which are now pure concentrated cane juice. Honey is a mixture of both these sugars, dextrose generally predominating. All sweet fruits contain one or other or both of them. Cane sugar when treated with a dilute acid yields an equal quantity of both of them in invert sugar. Even continuous heating at the boiling point of water has a tendency to transform ordinary sugar into invert sugar. Both dextrose and lævulose crystallize with great difficulty. If present in a solution of sucrose they probably exercise a retarding influence on the crystallization of that sugar. Any agent, therefore, having a tendency to invert any of the sugar in the juice or syrup is doubly objectionable. Sulphur dioxide in solution has this tendency, especially when hot. Long boiling at high temperatures has also the same tendency. Both should be avoided as much as possible on this account.

In addition to the three sugars already named, at least seven others occur in nature, among these are milk sugar and malt sugar, *lactose* and *maltose*. But several times the number are known to chemists, some of them are fermentation or decomposition products, others have been made by the synthetical method. However, so far as I know, no cane sugar has ever been made by either of these ways. The stories sometimes heard that cane sugar is now made for commercial purposes from rags and sawdust are a myth. Perhaps they have arisen from the fact that dextrose is made from starch and possibly, at times, from such substances as I have just named.

Sugars belong to the carbohydrates, a class of compounds ably treated by Mr. F. T. Shutt, M.A., in a lecture on the Chemistry of

Foods, delivered before the Field Naturalists' Club during the winter of 1892. The sugars are the most soluble and the simplest members of this group. Their study from a chemical standpoint is exceedingly interesting, especially in relation to plant life, since it is highly probable that the other carbohydrates are formed from them.

REPORT OF THE CONCHOLOGICAL BRANCH, 1893.

Presented at the Annual Meeting, March 20, 1894.

To the Council of the Ottawa Field Naturalists' Club.

The leaders of this branch beg to report that while they have not during the year given as much attention to the study of the shells of this vicinity, as they, in duty, were probably bound to do, they have nevertheless something of interest to report as the result of their observations. Two new shells were added to the Ottawa list during the year, both discoveries having been made by the Rev. G. W. Taylor. *Pupa curvidens* was noticed among a number of small shells taken at Hull. In ponds near St. Louis Dam, the small English *Planorbis nautileus* var. *cristatus* was taken for the second time on this continent. It had previously been found in America only at Hamilton, where it was collected three years ago by Mr. A. W. Hanham. The occurrence of this shell at Ottawa, nearly 4,000 miles from its home, indicates how readily, in modern days, shells may become widely distributed. Its presence in the ponds at St. Louis Dam is in great probability due to the large quantity of refuse packing material, such as straw envelopes, marsh grass, etc., which have for years been thrown into these ponds. It may be that the shells themselves could not withstand the changes to which the straw and grass would be exposed from the time it was gathered in England until it was thrown into the ponds, but from the extraordinary vitality which the eggs of molluscs are well known to possess, these might continue unimpaired even under the trying circumstances that must have obtained in this case.

An important find of the exceedingly minute and rather rare *Vertigo milium* was made in Billings's bush, one wet afternoon in August on the bark of a fallen oak. Here, in ten minutes, many more specimens of this shell were found than the collector had previously

seen in ten years. The large *Planorbis*, usually called *trivolvis*, but which, in the opinion of the leaders, is quite a distinct species, was found in abundance in the Rideau River west of Billings Bridge. The shells are easily obtained in the month of May, when like all other *Planorbes*, they are very active. Observations on this shell from the egg through various stages of growth to the adult shell may be stated at some future time and a description ventured.

The trip to Meech's and Harrington Lakes, of which an account is given in number 7, vol. vii, of The OTTAWA NATURALIST, although undertaken under adverse circumstances, was attended with very happy results. An excursion to Lake Bernard, in still more inclement weather, met with little success, as but few shells could be collected. The Gatineau River, owing to its rapidity and the few bays which it contains, is noted for the absence of molluscan life. At Farrelton, however, in September, when the water was very low, a surprisingly large number of shells were obtained. Our three Margaritanas were found in abundance, and several others of the Unionidæ. The Ottawa River was too high throughout the summer to admit of successful collecting. The famous shoals at Duck Island, on one occasion, however, yielded a number of shells which amply compensated for the long row up and down the river.

A remunerative method of collecting small shells was found to be the gathering of moss during the autumn from woods and swamps. This moss is then sifted during the winter. In this way no less than 14 species were collected in one bag of moss taken from the edge of the swamp to the south of the St. Louis Dam.

The leaders will be pleased at all times to assist members either with instructions as to the best methods and localities for collecting, or in the naming of species.

F. R. LATCHFORD,
J. FLETCHER, } *Leaders.*

EXCURSION No.

Will be held on Saturday, September 15th, to Galetta on the O. and P. S. Railway.

The Train leaves at 8 A.M. Tickets, 60 cts. and 50 cts.; Children half-price.

LIBRARY MASS.

ANNUAL REPORT OF THE COUNCIL, 1893-1894.

To the Members of the Ottawa Field-Naturalists' Club :

In presenting this, the fifteenth Annual Report of the work of the Club, your Council has to announce that the year just closed has been one in which the Club's success, usefulness and activity have amply repaid the amount of time and labour devoted to it.

The very large attendance at the Excursions held during the summer season to Wakefield, Rockland and to Borthwick's shows plainly to what degree of popularity our spring and summer outings have attained.

Nineteen new members were elected by your Council and their names added to the membership roll. A few have resigned for various reasons.

Ten meetings of the Council were held during the past year at different times for the transaction of routine business, appointing leaders, preparing for excursions and soirees, and the publication of the OTTAWA NATURALIST.

Six soirees or evening sessions of the Club were held during the winter months as follows :

Dec. 12th.—Inaugural Address : The extinct Northern Sea-cow and early Russian Explorations in the North Pacific.
Dr. G. M. Dawson, C.M.G., F.R.S.

Jan. 9th.—Following a Planet. (*With lantern illustrations.*)
A. McGill, B.A., B.Sc.

Jan. 23rd.—Biological Water Analysis. (*With lantern illustrations.*)
Dr. Wyatt Johnston, Montreal.

Feb. 6th.—Disintegration and Denudation of Rocks.
Frank Adams, Ph.D., (McGill College, Montreal.)

Feb. 20th.—The Transmutations of Nitrogen. (*With chemical experiments.*)..............Thos. Macfarlane, F.R.S.C.

Mch. 6th.—Ottawa Butterflies......James Fletcher, F.L.S., F.R.S.C.

Notes on the Natural History of the Islands of Behring Sea..........................James M. Macoun.

The OTTAWA NATURALIST has been promptly published by our able and zealous editor, Mr. W. H. Harrington, on whom the *onus* of the editorial work has practically entirely fallen.

One of the first duties of your Council after election was to appoint Mr. Harrington as editor, and with this appointment the position of sub-editor was assigned to each of the following gentlemen engaged in various branches of work in connection with the Club, viz :—

1. Geology .... Dr. H. M. Ami.
2. Mineralogy .... Mr. W. F. Ferrier.
3. Botany .... Mr. William Scott.
4. Entomology .... Mr. James Fletcher.
5. Conchology .... Mr. F. R. Latchford.
6. Ornithology .... Mr. A. G. Kingston.
7. Zoology .... Mr. F. T. Shutt.

As may be observed in reading the NATURALIST for the past year, various notes bearing on these different departments of the Club's work above mentioned have appeared from time to time. It is earnestly desired, and this Council recommends, that this branch of the Club's work be carried on efficiently in the future, inasmuch as this method not only furnishes the editor with material for the monthly periodical, but gives also to the members current and interesting notes in these different topics.

Early last year a number of members of the Council and Club received blank forms prepared by a Committee of the Royal Society of Canada on which to record phenological observations. These have been filled and handed back to the Committee of the Royal Society whence they came.

The Council and the Club generally, have been under great obligation to one of their number (during the past year) in the person of Miss A. M. Living for the gratuitous designing and drawing of the beautiful cards of announcement of the different lectures and soirees given under the auspices of our Club.

Your Council has just recently had prepared a memorandum to be presented by the Hon. E. H. Bronson before the Ontario Legislature, stating the claims of the Ottawa Field-Naturalists' Club for aid and subsidy towards publishing the OTTAWA NATURALIST and for general educational work carried on.

The Treasurer's statement shows that after defraying all current expenses, including printing and publishing of the OTTAWA NATURALIST, our official organ, there is still on hand a balance of $25.92.

A number of members are now in arrears. It is earnestly hoped that all will promptly settle with the incoming Treasurer and thus enable the Club to go on increasing in usefulness as in the past.

Sub-excursions were perhaps not held as frequently nor at as regular intervals last year as in former years. This part of the Club's work was a very prominent feature at one time. Our Saturday afternoon walking parties were very popular, and would, no doubt, be more so if the leaders would make it convenient to be present at the General Post Office at 2 o'clock as formerly.

The thanks of the Council and of the Club are due to Messrs. W. C. Edwards, M P., and Archibald Stewart, also to Mr. William Borthwick, for the hospitable manner in which they received the Club at the Rockland Quarries and at Borthwick's Springs.

We regret that, owing to the departure from Ottawa of Mr. William Scott, late Mathematical and Science Master at the Normal School, we have lost an active and zealous member of our Club. In his position as Librarian, Mr. Scott did good and efficient work for the Club. Since his departure your Council have unanimously chosen and requested Mr. R. H. Cowley, B.A., to act in the capacity of Librarian for the balance of the term up to this annual meeting.

To Dr. MacCabe, Principal of the Normal School, the Council of the Ottawa Field-Naturalists' Club feel greatly indebted for his kindness and generosity in granting us the use of the room in which we assemble now for the evening soirees during the winter months.

To Mr. McGill, to Dr. Wyatt Johnston, to Dr. F. D. Adams and to all who have assisted in making the past season a successful one, the Council desires to record its obligations.

In conclusion your Council beg leave to thank the members for the zeal and interest manifested at the Excursions during the past year and also at the winter soirees, and trust that the incoming year will mark another era of progress for the O.F.N.C.

HENRY M. AMI,

Ottawa, March 20th, 1894. *Secretary.*

REPORT OF THE GEOLOGICAL BRANCH, 1893-94.

To the Council of the Ottawa Field Naturalists' Club:

In presenting the report of this branch of the Club's work for the past year, your leaders have to announce that considerable progress was made in examining the geological features of the districts about Ottawa and especially in the vicinity of the localities visited by the Club. Reports upon the facts observed on the excursions have appeared from time to time in the OTTAWA NATURALIST.

On two occasions, at the general excursions to Wakefield in May and to Rockland in July, your leaders performed the duties incumbent upon them. At the latter place one of the leaders collected a large amount of material in the way of rock-specimens and fossils from which he prepared a paper entitled : "Notes on the Geology and Palæontology of the Rockland Quarries and vicinity, in the county of Russell, Ontario, Canada." This paper has since been published* and contains interesting reports on the chemical composition, the microscopic characters and petrographical and other physical relations of the limestone rocks in question. To Dr. B. J. Harrington, to Prof. H. P. Bovey and to Dr. A. P. Coleman, the writer is indebted for reports on these points.

As sub editor in the department of Geology, Dr. Ami has also prepared a number of interesting book notices and reviews of articles of general as well as local value. It is to be hoped that in the coming numbers of the OTTAWA NATURALIST there will be found notes on mineralogy, stratigraphy, palæontology and kindred departments of geological research in regular and systematic sequence.

There is a decided need of some publication here in Canada taking hold of this important branch of work, so that we heartily recommend the re-appointment of sub-editors in the various branches of the Club's work by the incoming council for 1894-95.

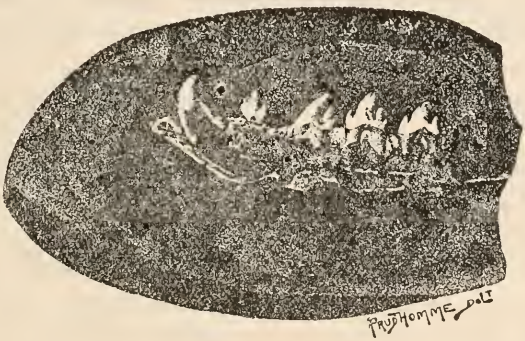
Early in the year two of the members of our Club, hearing that Mr. John Stewart was leaving the city, secured the balance of the geological collections he had made about Ottawa and elsewhere during

*OTTAWA NATURALIST, Vol. vii., 1893, No. 9, pp. 138-147.

the past ten years. These have all now been well nigh studied and determined. The bulk of the fossil collection, consisting of crinoids and cystideans, on which Mr. Stewart had spent a great deal of time, were purchased by Mr. J. H. R. Molson for the Peter Redpath Museum of McGill College, Montreal, and is now on exhibition in the cases of that institution.

A small collection was sent to Prof. F. A. Bather and Dr. Henry Woodward, of the British Museum, who expressed themselves as highly delighted with the specimens sent.

Dr. Ami is preparing a list of the species of fossils in the Stewart collection. Besides those from Ottawa and its environs there are not a few from Belleville, Hastings, Madoc, Havelock, and from other localities in central Ontario.



The discovery of a *gouge* by Mr. J. Ballantyne or stone implement belonging to the aborigines of this portion of Canada in Mr. Graham's brickyard at Archville (Ottawa East), led to an interesting examination of the circumstances attending the finding of it. Amongst the fossil remains collected in the beds of clay and sand, were the following :

1. Leda (Portlandia) arctica, Gray, abundant.
2. Macoma fragilis, Fabricius.
3. " calcarea ? Chemnitz.
4. Natica affinis, Gmelin.
5. Cylichna alba, (Brown.)
6. Balanus crenatus, Bruguière.

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Of these, No 5 is an addition to our list of Pleistocene shells from the Ottawa district.

Amongst the interesting specimens of Pleistocene fossils which came under our notice of late, was a portion of the lower jaw of a young seal found in a nodule of calcareous matter at Green's Creek.—This specimen was in the possession of Sir James Grant—one of our members. Sir James handed it to Dr. Ami, who had it photographed and reproduced (see accompanying cut), so that our members may have an opportunity of seeing it, and also for the purpose of placing it on record.

During his researches in the Ottawa and Gatineau districts, Dr. R. W. Ells noted the occurrence of marine shells at two localities, viz:—

(1.) MacGregor's Lake, two miles north of Perkins's Mills, at an elevation of 450 feet above sea-level. *Saxicava rugosa*, L., (= Saxicava pholadis) was found in great abundance with a remarkably firm and thick test.

(2.) Near Cantley, P. Q., three species of Pleistocene and marine shells :—

1. Macoma fragilis, Fab.
2. Saxicava rugosa, L.
3. Leda (Portlandia) arctica, Gray.

HENRY M. AMI.
R. W. ELLS. } *Leaders.*
W. F. FERRIER,

March 19th, 1894.

RECENT DEPOSITS IN THE VALLEY OF THE OTTAWA RIVER.

By R. W. Ells, LL. D., F. G. S. A., F. R. S. C.

The question of the evolution and subsidence of the earth's crust is one which in recent years is engaging much of the attention of leading geologists both in Canada and the United States. Various opinions have been expressed on the subject, some contending that the submergence of the land can be measured by a very considerable amount ranging from 1,000 to 2,000 feet or even more, while others maintain that the change of level is very much less. Controversy on this point at times waxes warm; for involved in the general question is that

of the distribution of the drift deposits of sand and gravel and the great areas of clay, either of marine or fresh water origin. In the former of these, the earliest traces of man's existence on this continent are supposed to be found, and his presence in America at a very remote date, comparatively speaking, is held by many observers to be clearly established. In many places the submergence of the surface beneath the sea is clearly proved by the presence of marine shells in beds or local deposits, or by the finding of the bones of the seal, of fish, or other forms of marine life; but the fact that very large areas of these clays furnish, at the present day, no trace of these remains, shews clearly that their absence in these deposits must not be taken as conclusive that these were not deposited under marine conditions equally with the beds which carry these organisms. So also the presence of characteristic sea beaches, composed of well rounded water-worn stones, at elevations of hundreds of feet above present sea level and far removed from the present ocean limit, establishes clearly the fact that at one time the salt sea spread over a much more widely extended area than it now occupies. Thus in the rear of the village of Quyon and four miles north of the Ottawa river several of these perfectly defined beaches can be recognized, their pavements of well rounded water-worn stones, curving in exactly the same manner as those now seen along the shores of the many bays of the Atlantic coast. Some of these well defined shore lines have been recognized along mountain slopes at elevations of hundreds of feet above the sea at various places throughout Northern and Eastern America. Near home probably one of the most interesting of these old beaches may be seen on the Rigaud mountain on the south side of the Lake of Two Mountains, which is the expansion of the Ottawa River, a short distance above its junction with the St. Lawrence. The mountain rises from the village of Rigaud, which nestles at its foot, to a height of about 750 feet above the river, the highest point being at its south-west extremity. From this point the mountain extends north-easterly in a long ridge, the elevation in rear of Rigaud village being about 500 feet. Along the summit of this, scattered boulders of limestone, gneiss and syenite from the Laurentian range north of the Ottawa are seen, but further down along the north-west slope of the ridge and almost in rear of the cemetery, a curious deposit of well rounded water-worn

stones occurs, which has a very considerable extent. In places the soil and thin forest growth has been removed and the rounded stones are laid bare sometimes over a space of several acres. These shew low terrace like ridges of eight or ten feet high, the whole deposit sloping towards the valley of the Rivière à la Graisse which flows past the northern flank of the mountain. The rocks comprising this curious deposit, which is known locally as the *Devil's Field*, are nearly all of reddish syenite often composed almost entirely of red felspar, with others of flesh-red felsite and porphyry, and a few of quartzite, the latter belonging presumably to some portion of the Laurentian, which is found on the north side of the Ottawa River. The bulk of the syenite and felsite rock is from the mass of Rigaud mountain itself. This deposit extends for several hundred yards along the north face of the mountain, and has a depth of from ten to twenty feet, though the bottom has not apparently been reached, but lower down the mountain side the deposits become finer, being largely coarse gravel and sand. There is every probability that this curious deposit marks an old shore or beach of the time subsequent to the glacial period. The locality has been briefly described in Geo'l. Can. 1863, p. 896, and is well worthy a visit from any one interested in the subject of glacial geology.

That the surface of the country was below the sea level at this period is clearly shewn by the presence of marine shells in extensive deposits of blue clay which is widespread throughout the valley of the Ottawa River. Along the streams flowing from the north, as the Rouge, Du Lievre, Gatineau, etc., it has been recognized for nearly 100 mile from their juncture with the main stream Frequently the clay deposits are covered by a mantle of sand often of considerable thickness. That the greater part of these clays are of marine origin is shewn by the finding of marine shells at elevations of 450 and 500 feet above present sea level at various points throughout the area. Along most of the rivers throughout this section a succession of terraces occurs, some of which along the upper part of the Rouge River are 1000 feet above the sea level. The distribution of the clays and sands throughout the northern area is very extensive; great areas as the Kazubazua plains embracing many square miles on which the soil is nearly pure sand, the vegetable growth consisting of small pine and blueberry

bushes; and these sandy deposits can be found for long distances north, probably to near the height of land. In deep cut sections the blue clay frequently appears in which, however, the marine organisms have not yet been found, and the mode of deposition can not therefore be distinctly affirmed. Marine shells have been found as far west as Bryson, on the Ottawa, and nodules like those of Green's Creek on Coulonge Lake 365 feet above sea level. It is thus clear that a very considerable part of the Ottawa basin has been submerged.

A very interesting point in connection with this question is the distribution of Laurentian boulders along the flanks of the mountain range which, traverses the eastern townships of Quebec, seventy to 100 miles south-east of the St. Lawrence River. Here on the slopes of the hill ranges which extend north-eastward from the Vermont boundary to Gaspé, scattered masses of gneiss and limestone from the Laurentian hills north of that river are found at elevations of 1000 to 1400 feet above the sea level. In the great valley between this ridge and the highland along the boundary of Northern Maine the drift has also been very extensive, clays and sand occurring at elevations of 800 to 1000 feet. This country has undoubtedly been submerged, and Hitchcock and others have recorded the presence of beaches and terraces along the mountains of Vermont and New Hampshire at elevations of 2000 to over 2500 feet. The whole question of submergence and elevation is of very great interest and the gradual accumulation of facts from many widely scattered points should, if properly interpreted, give us much reliable information when properly correlated. Unfortúnately, however, the peculiarities of many minds prevent these facts from being regarded from the same stand point, so that while one sees in these phenomena the clearest evidence of submergence and sea beaches another sees only elevation and terminal moraines.

There is yet a large field of study along the Ottawa River and the many tributary streams for those who are interested in this branch of scientific investigation, and many points, a few years ago accessible only with difficulty and much expense, can now be readily reached by the various lines of railway lately constructed. There is no doubt therefore that fresh facts bearing on the question will rapidly accumulate and the vexed question of submergence or continental glaciation may be satisfactorily settled in the not far distant future.

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EXCURSION TO GALETTA.

The last excursion of the season was held on Saturday, the 15th of September, to Galetta, on the Ottawa Arnprior and Parry Sound Ry. This excursion, notwithstanding that it was not largely attended, was decidedly a successful one. The day, although rather overcast early in the morning, turned out all that could be asked by the most fastidious. The locality visited, is one of great natural beauty, and the arrangements made by the acting-president, Mr. Shutt, were such as to call forth the grateful appreciation of all who were fortunate enough to participate in this pleasant outing. On arriving at the Galetta station the party was met by Messrs. George and Galetta Whyte, and escorted to the town hall, which had been kindly placed at the disposal of the excursionists. Here, without further delay, the lunch baskets were deposited, and the Naturalists divided themselves into two parties, one under the guidance of Dr. H. M. Ami went off to examine the rocks and collect geological specimens. The larger number, led by Mr. Galetta Whyte, and with Mr. Robert Whyte and Mr. Fletcher as botanical leaders, and Dr. Ells as geologist, started off by a circuitous path through the woods, towards Dingley's Syne. Many specimens of interest were collected on the way. Wood-ducksin large numbers and a few "partridge" were seen around the frequent ponds. When the Syne was reached most of the party were glad to rest in the shade, after their hot walk. They were not, however, idle, and the stream furnished many nice specimens of freshwater shells and water plants. Upon returning to the village again an hour was profitably spent in refreshing the inner man, and at 2:30 all were called together to hear the addresses of the leaders, which were delivered in Mr. Whyte's beautiful grove, close to the village.

Galetta is a thriving village about thirty miles from Ottawa, on the south and east sides of the Mississippi River. There are several pretty houses, a good store, a grist mill and a woollen factory. A notable feature of the locality is the magnificent water power, which has only to some extent, as yet, been made use. For some distance above and below the village the river is rapid and cut up by most picturesque chutes or falls, overhung by tree-laden banks. A mile distant, on the top of the hill is the comfortable homestead of Mr. Charles Mohr, well known throughout the district for his hospitality.

The party having assembled and taken their places on the comfortable seats arranged in the grove, were called to order by Mr. Shutt, who congratulated those present on the success of the day, and then called on Dr. H. M. Ami, the geological leader, for the first address. The doctor spoke as follows :

The various geologic formations met can all be classified under two heads, viz : I. *Archæan* ; II. *Post-Tertiary* or Pleistocene.

1. *Archæan System.* Crystalline limestones constitute the most prevalent rock at Galetta. They are for the most part light-coloured and coarsely crystalline, oftimes assuming a decided coarsely saccharoidal texture. This rock weathers dark, chiefly owing to the growth of lichens, &c., and has been considerably used in the manufacture of lime for local use. On examination the limestone is seen to contain minute scales or crystals of mica, which are at times more extensively developed and form masses of rock in which mica predominates. Graphite or plumbago and iron pyrites also occur here and there in small quantities. Chondrodite is also present in the shape of amber-coloured crystals. This limestone thus would be a chondrodite limestone. The limestone is traversed by numerous dykes of what appears to be a true syenite or hornblendic granite. At times this rock occurs as a homogeneous paste with orthoclase felspar, quartz and hornblende, in about equal proportions, at other times the felspar and hornblende are separated and occur in layers, the hornblende forming the line of weakness in a vein, then next to this orthoclase felspar, then the homogeneous combination of the two with a resinous gray-coloured syenite. Galena, wollastonite, graphite, calcite, and mica, are associated with the crystalline limestone.

2. Post Tertiary.—Formations belonging to the glacial epoch, to the later marine period and even to the still later period of elevation are evident at Galetta. Boulder clays overlying the glaciated and rounded hills, which are decidedly "moutonnees," are in turn capped by marine gravels and clays and these to-day afford the rich soil of the farms in the locality. Erratics may also be seen scattered in various directions, some of them nearly ten feet in diameter, these indicate a period when the Ottawa Valley was submerged and floating and shore ice were amongst the agencies at work in transporting the boulders.

All were much pleased with Dr. Ami's entertaining and instructive address.

Mr. Fletcher was then called upon, and spoke of some of the more interesting objects observed during the day. He showed specimens of ten different species of bivalves collected in half an hour at the Snye, and explained the formation of the shells of mollusks, the development from the egg and the changes gone through in the course of growth. He also spoke on some of the aquatic insects collected, paying particular attention to Caddis flies and a beetle, *Psephenus lecontei*, the interesting larva of which had been found in numbers under stones in the river.

The last speaker was Mr. Robt. Whyte, who is always listened to gladly by members of the club. He spoke in his usual entertaining manner, on the plants collected, and being in particularly good form on this occasion, the time for departure arrived all too soon, and there were many regrets that he could not have spoken longer upon some of the tempting specimens that he exhibited. Among the plants treated of, the following may be mentioned :—*Valisneria spiralis*, the "water celery" eaten so greedily by the Canvas-back and other wild ducks. The remarkable mode of fertilization of which was explained. *Shepherdia Canadensis*, showing the flower buds already formed for next spring also some thistles and asters which formed a conspicuous feature of the landscape, as well as some other composites, *Impatiens fulva* with its cleistogamous fertile flowers, the cardinal flower and many other woodland beauties too numerous to mention.

At 3:20 the speaking had to be stopped for the party to go to the train. At 4:30 the city was reached and all returned well satisfied with one of the most pleasant excursions the club has held this season. Great praise was accorded Mr. Shutt for the trouble he took in looking after everyone's comfort and the excellent manner in which he managed everything during the day. Mr. Ebbs of the C. A. R. and the polite conductor of the train, Mr. Roberts, were also gratefully thanked for their successful efforts to make everything as convenient and agreeable as possible for the party.

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BOTANY.

Edited by John Craig.

Potato Rot.—The advantages of spraying potatoes with the Bordeaux mixture for the prevention of potato rot are well shown on the experimental plots now being dug at the Central Experimental Farm. The dry weather which prevailed throughout August and in the beginning of September gave conditions very unfavourable for the development of the parasitic fungus (*Phytophthora infestans*, DeBy.), which causes potatoes to rot; but the advantage, to those plants of which the foliage was kept green for some three or four weeks longer than on the untreated plots, is plainly shown by the far larger crop and the much better tubers. The reason of this is, of course, quite plain. On the untreated plots the leaves—the starch-making organs of the plant—were destroyed by the potato rust (which is merely another form of *P. infestans*) just at the time when they were required to collect and manufacture starch to be afterwards stored up in the tubers. In the case of the treated plants, on the other hand, these organs were preserved by the application of Bordeaux mixture and kept on performing their proper functions for another month, at the time of the year when this was of most importance to the crop; moreover, had the weather been wet during August and September it is probable that, not only would there have been a difference in the size of the tubers on the untreated plots, and consequently in the number of bushels reaped, but a large proportion of these would have been rotten. J. F.

Spraying to prevent Fungous Diseases.—Much has been said and written upon this subject since the practice was recommended some six years ago. Much remains to be learned, but great progress has been made, and the orchardist of the future will view spraying to prevent fungous and insect attacks in the same light, as bearing upon the success of his fruit crop, as the intelligent grower of to-day does the important operations of cultivating and manuring.

Very satisfactory results have been attained by the horticulturist of the Experimental Farm in treating apples and pears for *Fusicladium dendriticum* "scab" or "spot", and *Monilia fructigena* "soft rot" on plums and cherries. A comprehensive series of experiments was

planned and carried out with the co-operation of the fruit growers of the St. Catharines and Grimsby districts. Copper Sulphate, 1 lb. to 25 gallons of water, was used for the early treatment before the foliage appeared, this was followed with three applications of dilute Bordeaux mixture to which paris green was added for the prevention of Codling Moth attack.

In apples and pears the results in quantity of fruit are sufficiently marked as to be readily recorded by means of photographs. Wherever the foliage was preserved, the fruit is of course larger, and of fine quality and appearance. Fruit growers are much encouraged with the results. J. C.

VIRGINIA CREEPER.—It is not generally recognized among Horticulturists and nurserymen that there are two varieties of the Virginia Creeper (*Ampelopsis*, *quinquefolia*.) They are identical in every respect except in the manner of attaching themselves to the object over which they climb. The type is supplied like the grape vine with tendrils which twine round string or wire supports or become wedged in the crevices of rocks; on a smooth surface, as a brick wall however, it is helpless. Not so its kindred variety, which is distinguished from it by being provided with little disks or suckers at the tips of the tendrils and by means of which it is enabled like its cousin the "Japanese Ivy," to scale the smoothest surface. At this season of the year the crimson drapery of its leaves is very beautiful on grey stone walls. Both varieties are found wild, and can be multiplied by layers or cuttings. J. C.

ASTER NOVÆ-ANGLIÆ, L.—In the October number of the OTTAWA NATURALIST for 1892, mention was made of a beautiful variety of the New England Michaelmas Daisy, sent from Toronto by Dr. J. E. White, the flowers of which varied from pale mauve to deep lilac. This plant has been grown in the perennial border of the Botanic garden, at the Experimental Farm, and is now in full flower. Growing with it, are also magnificent plants of the type of the species with purple flowers and of the var *roseus*, these were also received at the same time from Dr. White, who collected the roots at Toronto.

A. Novæ-Angliæ, L. var *roseus*, Gray, is one of the most attractive plants in the border forming a large bush five feet high and three feet through, a mass of lovely rose-purple flowers. This is undoubtedly one

of the most desirable of all of our wild flowers for cultivation in gardens and will certainly become commercial before long.

ASTER MULTIFLORUS, Ait.—Fine specimens of this species are also now to be seen in full flower in the Botanic garden. The profusion of pure white flowers make this Michaelmas Daisy also a very desirable late-flowering garden plant. The roots were received from Toronto and Manitoba.

GEOLOGY.

Edited by DR. R. W. ELLS.

1. THE AGE OF THE NIAGARA RIVER.—There is still considerable diversity of opinion as to the probable age of the Niagara river. In *American Geologist* for September, Warren Upham computes the age of the Niagara River at 7,000 years (see p. 199); whilst Dr. Spencer places the same at 32,000 years.

2. MOUNT ST. ELIAS.—It is certainly gratifying to hear that the results of recent observations on the Alaskan boundary have proved this volcanic peak to be in British Columbia and not in Alaska. There are several peaks in that region which are higher than St. Elias, whose summit touches the clouds at 18,000 feet, amongst these is Mt. Logan, (called in honour of Sir Wm. Logan) the highest peak in North America. The altitude of Mt. Logan is 19,685 feet above the sea.

3. DEATH OF GEORGE H. WILLIAMS.—It is with feelings of deep sorrow that we have to chronicle the death of one of the foremost men in the ranks of geological science on this continent. In the August number of the *American Geologist*, p. 136, there is a brief obituary notice which is here given :—

"George Huntingdon Williams, Professor of Inorganic Geology in Johns Hopkins University and Vice-President of the Geological Society of America, died of typhoid fever, at his father's house, Utica, N. Y., July 12th, aged 38. Prof. Williams graduated from Amherst in 1878, and studied under Rosenbusch at Heidelberg, where he took the degree of Doctor of Philosophy, in 1882; the next year he became connected with Johns Hopkins and was associate professor there from 1885 to 1892, when he was appointed to the chair he held at his death. A number of the younger geologists of the country have studied under

him, and to them, as well as to all who knew him, the news of his death comes with special sadness."

Latterly Dr. Williams devoted special attention to the petrography of the rocks from the volcanic regions of America. He has contributed to science a large number of useful papers on various topics, a list of which will shortly be published in the *American Geologist*. With a number of our Canadian geologists Dr. Williams was intimately associated, not only by the nature of his studies, but also by his geniality and uniform kindliness. A great gloom is certainly cast by his death over the prospective meeting of the Geological Society of America at Baltimore, as his absence will be more than strongly felt. H. M. A.

4. NEPHELINE SYENITE IN ONTARIO. In the *American Journal of Science* 3, Vol. XLVIII, pp. 10-16, July, 1894, Dr. Adams, Logan Professor of Geology and Palæontology at McGill Uuiversity, contributes an article entitled "On the occurrence of a large area of Nepheline Syenite, in the Township of Dungannon, Ontario." The region in question is there described as one in the midst of Laurentian rocks, and it is stated that this is the first discovery of Nepheline Syenite in the Laurentian System of Canada. This adds another to the list of the few localities in the world where Nepheline Syenite occurs. The Mount Royal outcrops of this interesting Rock of probable Devonian age, are well known and need not be referred to here.

The fact that this rock penetrates and cuts newer but palæozoic strata at Montreal and elsewhere, would lead us to look for outcrops of similar age, (right in the heart of the areas coloured Laurentian on our geological maps.

It is evident, however, that if the Nepheline Syenites of Mount Royal, Montreal, Quebec, are intruded through Cambro-Silurian Strata —they must also cut underlying Laurentian or Archæan rocks, and similar syenites ought to be looked for in Laurentian areas not overlain by palæozoic rocks. H. M. AMI.

WINTER SOIREES.

The soirée committee is now preparing the programme for the winter meetings. Any members who wish to submit papers or short notes, will oblige by sending in their titles as soon as possible.

MARVELS OF COLOUR IN THE ANIMAL WORLD.

A very interesting and instructive popular science lecture was delivered by Prof. Prince, Commissioner of Fisheries, in St. James' Hall, under the auspices of the "United King's Daughters," on the 26th March.

The Chairman, Sir Charles Hibbert Tupper, K.C.M.G., introduced the lecturer in his usual happy manner. The lecturer, after explaining the decomposition of light, went on to show that white animals and silvery creatures, like fishes, illustrated specular reflection. Striated surfaces broke up sunlight into prismatic colours, and produced in the feathers of birds, wing-cases of insects, pearly shells, etc., most gorgeous hues. Similar tints might be due to what the physicist calls "thin plates," instances of which occur in jelly-fishes and many glassy marine animals. One of the most frequent causes of colour was pigments or actual colouring matter in the tissues, in the skin, hair, or feathers. Three forms of pigments might be distinguished, viz: minute corpuscles, capable of expansion and contraction and usually stellate in shape, or larger masses called chromatophores, with muscle and nerve supply and controlled by the optic ganglion or, finally, a fluid bathing the tissues in the form of a dye. External conditions affected the pigment, the coloured particles altering their shape, and quickly changing the colour of the skin, as in the chameleon.

Most interesting examples of colour were found in very young animals. By studying them we gained information about adult colours. Animals are usually colourless in the earliest days of their existence. Amongst worms, insects, crustaceans, ascidians, fishes, reptiles, birds and even the highest animals there is a time when they are colourless and wormlike in form. The surface of the sea is a vast nursery for young creatures of various kinds exhibiting these characters. When, at a certain stage, colour appears, it is found to correspond to the form of the body. It occurs as repeated stripes or patches. A young cod, for instance, when three days old, is an insignificant eel-like creature, transparent and with four bold stripes of black on the sides of the body. These stripes later break up into spots. This spotted or striped character prevails amongst myriads of young animals. Wild pigs when young are

striped, the lynx is spotted, the lion-cub is spotted: but these marks disappear. They are of no use and simply persist as an ancestral landmark in each generation. In some striped creatures, the zebra, tiger and leopard, these external marks have proved of use and have persisted. Passing from ancestral coloration, Professor Prince referred to colours due to food, instancing the green oyster and the cochineal insect. Other colours may be called physiological, like the red or green colour of worms due to the hue of the blood. We have also emotional (cuttlefish); aesthetic (sex colours of birds, etc.,) and seasonal coloration. The stoat and hare turning white in winter illustrate the last. Parasitism furnishes strange instances, the green sloth owes its colour to minute algae which clothe the coarse grey hairs of that animal. Environment is most potent in causing animals to assume the colours of their surroundings. Insects afford striking cases. Strikingly tinted creatures such as the skunk, amongst quadrupeds, and the wasp among insects, exhibit warning colours. Mimicry is of great interest and there are many types, the most interesting being that of harmless insects mimicking poisonous or disagreeable kinds. Lastly, many colours appear, in our present state of knowledge, to have no useful purpose, and must be classed as indifferent. Interior organs and membranes are coloured in various ways for which no explanation is at hand. Why should the chimpanzee possess a palate of a bright rose colour, and the interior of the orang's mouth be black as ink? Much still remains to be done in this subject, and few subjects present more facts curious and interesting in themselves but also of far-reaching significance.

On conclusion a vote of thanks was moved by His Excellency the Governor General, who congratulated the Chairman upon having been able to secure the services of such an able man as the lecturer to discharge the duties which had been assigned to him by the Department of Marine and Fisheries. The motion was seconded by Sir James Grant, carried unanimously, and very suitably acknowledged by the lecturer, who then moved a very hearty vote of thanks to the Chairman, which was seconded by Dr. Sweetland.

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ENTOMOLOGY.

Edited by J. Fletcher.

The Sumach gall.—Fine specimens of the curious and pretty gall which is sometimes found beneath the leaves of the Stag's horn Sumach, have been sent from Nictaux Falls, Annapolis county, N.S., by Prof. A. H. Mackay. This gall, which varies very much in size and shape, but is generally somewhat spherical and from ½ to 1 inch in diameter, is formed by one of the gall-making plant lice beneath the leaves of both the Stag's horn and Smooth Sumach. The colour is the same as that of the leaves, and like the latter, turns to a brilliant scarlet in the autumn.

In the American Entomologist for 1869, Prof. Walsh says:—"Early in spring, as we have been informed by Dr. Manlius, each gall contains but a single wingless mother louse with numerous larvæ." At this time of the year, when the galls drop to the ground, they are found to be little more than hollow bladders filled with enormous numbers of winged plant lice. Numerous specimens were collected at Kirk's Ferry last year and attracted much attention; some of the largest galls resembled small tomatoes. The insect which causes these curious excrescences is known by the name of *Pemphigus rhois*, and belongs to the Aphidæ or Plant lice.

Eacles imperialis.—I have received a specimen of this large and beautiful moth from Mr. T. W. Ramm, of Ross Mount, Northumberland county, Ontario, who writes as follows concerning its capture:—"I am not certain of the date, but it was at the end of June or the beginning of July, when I found two specimens of the Imperial Moth mated on a piece of an old log, on the side of the Port Hope and Peterboro gravel road, on Lot 35 in the 7th Concession of the Township of Hamilton. This is the last Lot, and the Concessions here number from the shore of Lake Ontario and are one mile and a quarter each. I had never seen the moth before, that I remember, in a residence here of 32 years."

Catocala relicta.—Mr. Ramm also sent, under date of Sept. 18th, a specimen of the above named handsome moth, which he had taken two days before. The colouring of this moth is chiefly white, with a few black marks, and Capt. Geddes has recorded an interesting habit, with regard to this species, of settling on white trees or other white objects. He has taken several specimens at rest on the white

tomb stones in a grave yard. It has been found in this city upon white gate posts and fences.

Anisota Virginiensis, Dru. (*Dryocampa pellucida*, A. and S).—Three pairs of this striking and rather rare moth have been taken during the past season. One perfect pair was taken by Miss Susie Almon, at the first excursion of the club, and kindly given to the leaders. The other two pairs were taken by Mr. Harry May and Mr. Harrington at Hull.

NOTES ON THE CATFISH.

During the past few months I have been closely observing the habits of the Catfish in my Aquarium. I find that these fish, during the day, lie comparatively quiet on the bottom, scarcely noticing food, unless dropped immediately before them, when they languidly literally bolt it, and again assume perfect indifference. As evening approaches however, they commence to swim about, frequently rising to the surface and drawing in air. This evidently is not from the absence of air in the water, or from impurity in the latter, as the same habits are noticeable even when the watei has been changed, just before dark. This, I think, settles the fact of their nocturnal habits. The exception is on the approach of wind or a storm, when the catfish becomes very restless, swimming about frantically with no apparent object, and as restless as the eel is under similar circumstances. The same habit has been noticed with the leech, and they thus become one of Nature's Barometers. Another curious feature might be mentioned, that when the Aquarium is exposed to continuous sunshine or bright light, the catfish assumes a light colour, the opposite being the case when in a dim light or darkened room. There is much yet to be observed in the habits of our fresh-water fish, of which we really know very little, from want of proper observation.

H. B. Small.

BOTANY.

Hypopitys Lanuginosa, Nutt. Flowering specimens of this curious plant were collected at Kirk's Ferry, on 9th July last, by Mr. W. E. Saunders. This is the only place at which it has been found near Ottawa. J. F.

Corallorhiza Striata, Lindl. Several plants of this beautiful orchid were collected last spring at Beechwood, and in the woods at the back of Rideau Hall. The first specimen was found by the Hon. Archie Gordon. At the meeting of the Ottawa Electoral District Agricultural Society, on June 5th, a bunch of the flowers was exhibited which had been gathered from these woods by Master Symmes. The species is very rare in this locality having been found but once previously in the same wood. J. F.

Podostemon ceratophyllus, Michx. One of the most interesting additions to our local flora, as well as to that of the Dominion, was made last August by Professor Macoun, in the discovery of large beds of the interesting River Weed. It was found growing on the bottom and creeping over the surface of the rocks in the rapids of Brigham's Creek, Hull, about 100 yards below the axe factory, and also further down the stream towards the Ottawa River. The description in Gray's Manual is an excellent one. There is only one species of the genus in Canada, which is a small ruddy or olivaceous plant of firm texture resembling a moss or sea-weed, which has no real roots, but is tenaciously attached to the bottom, loose stones, or other objects in the water, by fleshy disks. The leaves are rigid, dilated into a sheathing base with pointed stipules and above mostly forked into about 3 thread-like or linear lobes which are again divided once or twice. The flowers are very interesting, they are nearly sessile in a tubular sack-like involucre, and consist of two stamens, of which the filaments are united below, two sterile filaments, one on each side, and a stalked ovary which bears two awl-shaped stigmas. Flowers solitary and very numerous. The capsules are pedicellate, oval, 8 ribbed, 2-celled, 2-valved, seeds minute, very numerous on a thick persistent central placenta. J. F.

Phragmites Communis, Trin. Specimens of this grass have been sent in by Mr. A. M. Campbell, of Perth, Ont., who was much struck with their beauty. He writes as follows :—"It is from the shores of Wicksteed Lake in the Temiscaming district. The Indian name for Wicksteed Lake is Shabasagi Lake, (river coming out on a point) and on the point where the inlet enters the lake grows this tall grass with its pampas-like plumes. I first saw this grass there last year, when we were surveying that lake. I also saw it in 1888 on the Lavase River, the

inlet of Lac Panache, District of Algoma. I cut specimens, this year, which measured 8 feet 6 inches in length and bore leaves 17 inches long. The stem was hollow and jointed like sugar cane ; the joints were from two to eight inches in length. Towards the top the long, narrow, pointed leaves grew out of one side and the whole was surmounted by a tuft of purplish, oat-like seeds. On one specimen I noticed three tiers of aerial roots radiating from the first three joints above the root, there being one and a half inches between the first and second tiers, and four inches between the second and third. There were six roots radiating from each joint. It is certainly a very handsome plant and some of the ripe plumes were very silky and pretty. J. F.

This grass has also been collected by Rev. G. Bousfield, about three miles from Billings Bridge. The nearest point to Ottawa at which it had been previously collected was Casselman (30 miles).

CYSTOPUS ON CAPSELLA. It is a common habit now-a-days to look upon all fungi as injurious plants. A walk through a neglected garden at the present time will, however, discover one member of this large family doing good work for the cultivator. Shepherd's purse (*Capsella bursa partoris*, *Moench*) is being freely destroyed by a form of mildew known as *Cystopus Candidus (P) Lev.* Unfortunately, however, this disease does not confine its attentions to Shepherd's purse, but is frequently found on other members of the mustard family and is also a common enemy of grasses when grown in badly drained soils. J.C.

AFFINITY BETWEEN STOCK AND SCION. In the development of new varieties the exact limit of possible hybridization is yet undefined ; the same is true also when applied to the multiplication of the individual by the art of budding and grafting. There are in both instances—in the one the science, in the other the art—many gradations between failure and complete success.

In hybridizing plants, not nearly related, the pulp or receptacle of the fruit (seed) frequently or usually developes, but may, or often contains only infertile seed. Again, in the case of uniting the wood of two widely varying plants by grafting or budding, while the operation may appear to be entirely successful the first season, as judged by the growth of the scion, yet examination frequently reveals the fact that no real union of fibre has really taken place between the stock and the scion.

A case in point came under our notice recently in connection with experiments made in using the Bird Cherry *(Prunus Pennsylvanica)* as a stock upon which to grow cultivated forms. A number of varieties of the Morello, or sour type of cherry, were budded upon this stock, with every appearance of success the first year, many making a growth of three or four feet. The following season a few varieties made little progress and showed a tendency to break short off, under very slight pressure, at the point of union with the stock. Examination of the broken surface shows that there was no union of fibre, the surface being quite smooth, but merely by contact sufficiently close to admit the mechanical passage of sap. It also exhibits numerous lines or rays of fibre diverging regularly from the pith to the laburnum, and resembling the ordinary medullary rays but curiously multiplied. Under favorable circumstances, growth, or at least the life of the scion, might be maintained for some years by means of this connection, but vigour and longevity could not be expected. Bird Cherry as a stock shows a greater affinity for some varieties than for others.

While on this subject it might be stated that lilacs grafted on green ash *(Fraxinus viridis)* will grow vigorously the first season, but invariably die the second year. J. C.

GEOLOGICAL NOTES.

SAXICAVA SANDS AND GRAVELS AT CARP, ONTARIO. *Macoma fragilis*, Fabricius and *Saxicava rugosa*, Linnæus, both marine species of shells which are at the present day found living in great abundance in the Gulf of St. Lawrence and along the Labrador and general North Atlantic coast, were collected by me at Carp village station in the gravel pit immediately south of the station. Some fifteen feet of stratified sands and gravels are here exposed. The upper portion consists of coarse sands and gravels, of the ordinary type in this formation, whilst the lower portion reveals the presence of a considerable number of well rounded and water-worn pebbles ; many of which vary in size from one inch to five inches in diameter. They are imbedded in a coarse matrix of sand and a number of accessories or impurities. These pebbles are for the most part derived from the crystalline limestone series of the Laurentian formations, probably of Archæan age, Pebbles of Chondro-

dite limestone are not infrequent, and are probably derived from the chondrodite limestones which lie to the north west of Carp station and the vicinity of Mississippi Lake. H. M. AMI.

PERSONAL NOTICES.

MR. LEHMANN. Two months ago we published a valuable and very readable paper on the manufacture of sugar from the cane, as practised in Louisiana, U.S.A., from the pen of Mr. Adolf Lehmann B.S.A., a member of the Club. As many of our readers know Mr. Lehmann personally, they will be interested to learn that he is now in Germany, prosecuting his studies in Agricultural Chemistry, with a view of taking the degree of Ph.D. For some years he was Assistant Chemist at the Central Experimental Farm, and in that capacity he did excellent work, all that he did being marked with thoroughness and ability. He then went to the Experiment Station at New Orleans, La., U.S.A., where, under the directorship of Dr. Stubbs he was especially engaged for a year and a half in the chemistry of sugar manufacture.

At Leipzic and Gottingen, Mr. Lehmann purposes making Bacteriology as applied to Agriculture, his special study. The Field Naturalists' Club wish him all success in his new field of labour. F.T.S.

MR. CARRINGTON. On October 17th some of the members of the Club had the pleasure of meeting Mr. J. T. Carrington, the well known English Naturalist who has just returned from Manitoba with Miss Winstone and Miss Flora Winstone, where they have been inspecting the working of the "Young Colonists' Aid Association." Mr Carrington is now the editor of that justly, very popular magazine, "Science Gossip" which has lately changed hands, and appears as a new series, in an improved form. Mr. Carrington was for 13 years editor of the English "Entomologist" and for many years was connected with the Natural History department of the *Field* newspaper. He is to have associated with him Mr. Edward Step, also an accomplished Naturalist. Mr Carrington made considerable collections of botanical specimens in different parts of Manitoba. While in Ottawa, the party visited the Departmental Buildings, the Experimental Farm and the Geological Survey. Mr. Carrington purposes to visit Canada again next spring, and we sincerely hope that it may be possible for him to attend one of our excursions. J. F.

A PROPOSED PHOTOGRAPHIC SECTION.

For some time past there has been evinced on the part of several of our members, the desire to form a photographic section in the Club. To put such on a good and firm basis, it would be necessary to obtain the names of at least twenty members who would be willing to pay a small annual fee, a fund being required to defray the expense involved in providing a dark-room, the use of certain chemicals and some preliminary instructions in the art and practice of photography.

With the exception of Ottawa, all our large Canadian cities have a camera club. The clubs have a large membership of amateur photographers and are generally in a flourishing condition. To keep up the interest an annual exhibition of work by the members is made. There is certainly a need of such an organization here, and all things considered, it would seem the better plan to form a section of the Field-Naturalist's Club for this purpose, rather than a new society.

Photography is not only an interesting and fascinating recreation, but a most instructive study, a study specially applicable to investigation in the various fields of Natural History.

We shall be pleased if those members who are wishful to form such a section of the Club will send their names to the Secretary, Dr. H. M. Ami, Geological Survey Department, Ottawa.

BOOK NOTICES.

One of the most interesting periodicals relating to scientific agriculture, which is received at this office, is the Agricultural Gazette of New South Wales. It is issued monthly by the Department of Agriculture of that colony; the subjects treated are always well prepared, carefully written and satisfactorily illustrated. While all departments are carefully edited, that relating to the field of botany is particularly interesting from an economic standpoint. We have before us the August number, and notice among the names of its contributors that of Dr. B. D. Halsted, Botanist and Horticulturist to the New Jersey Experiment Station. Dr. Halsted is known in Canada, but more especially in the United States as one of the foremost mycologists of the day, and an accepted authority upon cryptogamic botany.

"Club-Root of the Cabbage and its Allies" (*Plasmodiophora brassicæ, Wor.*) is the text of Dr. Halsted's interesting article. The nature and history of the disease which causes the roots of cabbage to become distorted, and which belongs to one of the slime moulds, is clearly described, and the best course of treatment outlined. Some of the conclusions reached are as follows :—

"The malady is due to a microscopic parasite which infests the cells of the roots, causing them to become swollen and distorted."

"The spores of the fungus, upon the decay of the part affected, become scattered through the soil, and from thence the enemy enters the plant."

"The disease affects several plants of the cabbage family, including turnips, kale, radish, stock and candytuft."

Among weeds, shepherd's purse and hedge mustard are also infested.

"Preventive measures must be relied upon, for the affected parts of the plant are below ground, and not readily reached by any fungicide."

"If the crop is diseased, all refuse at harvest time of roots, stems, and leaves should be burned."

"All seedlings from hot-beds with signs of club-root should be destroyed, and if possible use only plants from beds in which there is no disease."

"Cabbage, kale, brussels sprouts, kohlrabi, turnips, or radishes should not follow each other on the same land if club-root is prevalent."

"Lime added to the land, 75 bushels per acre, has proved effective. It is possible that some commercial fertilizers may be found to check the trouble."

"Keep the land free from shepherd's purse and hedge mustard, and other weeds of the same family, as their roots become "clubbed" and thereby propagate the enemy."

Among other articles of interest in this readable pamphlet, is one on the possibility of utilizing a native, and hitherto noxious weed, known as "Paddy's Lucerne" or "Queensland Hemp" (*Sida rhombifolia, Linn.*,) as a fibre plant. Another describes "A New South Wales Bitter Vine" (*Piptocalyx Moorei, Oliv.*,) from which a drug of at present unknown properties is prepared.

The notes by consulting botanist J. H. Maiden "On Colonial Timber for Carriage-Building" are of much practical value, describing as they do the physical properties of many of the native woods, and giving their chief lines of usefulness. It is somewhat surprising to see the Gums (*Eucalyptus*) classed among hard woods, and recommended for cart and wheelwright's work, with the statement, that for such purposes there is "no timber to approach them." J. CRAIG.

WINTER MEETINGS.

The Soirée committee has almost completed the preparation of a programme for the course of evening meetings to be held during the winter, and it is promised that the Soirées will be exceptionally interesting. There will be a return in some measure to the procedure of the earlier years of the Club, and the course will be devoted entirely to natural history subjects. On December 6th it is proposed to hold a conversazione, when Dr. Dawson will deliver a brief inaugural address; the remainder of the evening being devoted to some interesting zoological subject. Then once a fortnight there will be evenings devoted respectively to Geology, Botany, Entomology, Conchology, Ornithology and Zoology. On each evening there will be two brief papers (not exceeding fifteen minutes) and the report of the leaders of the branch, with short notes which may be sent in by any member. Specimens will be exhibited to illustrate the proceedings, or when they are of exceptional interest. The committee again invites any member who may wish to contribute notes, or who desires to exhibit specimens, or otherwise assist in the meetings to communicate with Dr. Ells as soon as possible. A complete programme will issue in good time. Ed.

JUMPING BEANS.

The Ottawa newspapers have recently had several notices of the arrival in the city of specimens of the so called "Mexican Jumping Seeds," and it may be of interest to give a brief description of what they really are. You all know the Codling Moth of the Apple, whose caterpillar injures and destroys so much fruit by making it wormy. Well the exact name of the appleworm is *Carpocapsa salitans*. The

plants infested by this insect in the United States are species of the genus Sebastiana, three in number, viz. *S. biocularis*, *S. palmeri* and *S. pringlei*, and it is found in California as well as in Mexico. The seeds in which the little grubs live, are about two-fifths of an inch long and subtriangular in shape; the two flat sides (where the seeds have pressed against each other in the ovary) forming a wedge, with the outer side rounded. The grub having fed internally upon the seed until nothing but a thin coated cell remains, lines it with silk and uses it as a winter residence. Before pupating it provides a way for it to escape from its prison when it becomes a moth, by partially cutting a circular hole through the wall and arranging an almost invisible trap-door which may be readily pushed open from within. You have seen caterpillars lashing their bodies about when disturbed, and it is supposed that the jumping bean is knocked about by similar movements on the part of its inmate, who fastens the posterior extremity of his body firmly to the silken lining, and then dashes his head against the walls. By this means the seed may be rolled over or twisted violently around, or, aided by its shape, move about upon a flat surface in an apparently mysterious manner. The first specimen seen by me was one which Mr. Walter Odell kindly brought to me last winter, but it had apparently jumped itself to death. There are known to entomologists, other species of insects which produce similar movements in seeds. A more complete account of the insect may be found in Prof. Lintner's Fourth Report on the Injurious and other Insects of the State of New York, 1888, pages 151-154. Ed.

NOTE.—The Treasurer, Mr. A. G. Kingston (Public Works Department), again requests the attention of members, who have not paid their subscription for the current year, to the clause in the Constitution, which enacts that such fees are *payable in advance.*

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THE MAGNETIC NEEDLE.

By A. W. Elkins, C.E., P.L.S., Lennoxville.

(*Read at the Autumn Meeting of the General Mining Association of the Province of Quebec, at Sherbrooke, Que., September 27th, 1894.*)

A slender bar of steel, charged with some of that mysterious, imponderable fluid or influence called magnetism, generally about five inches long and about one sixteenth of an inch thich, pointed or wedge-shaped at the ends, and provided at its centre with a cup-shaped piece of very hard metal, or precious stone, so arranged that the bar may freely turn upon a pivot, is essentially the simple little instrument known to-day the world over as the Magnetic Needle, which possesses the wonderful property of remaining in a direction, or of turning upon its centre until it assumes a direction, nearly North and South, and this provides data from which the direction of the geographic poles of the earth can be inferred with a fair degree of accuracy.

Such is the essential part of the instrument, which, for at least seven centuries, has been the greatest boon to navigators, and of inestimable service to explorers of unknown territory.

The early history of this simple but invaluable contrivance is lost in antiquity. It is thought that the Chinese were its inventors ; and one authority states that the Emperor of Ho-Ang-Ti, marching with his army against the enemy, finding himself embarrassed by fog, constructed a chariot which indicated the South. This was in the year 2634 B.C., and it is supposed that the Magnetic Needle was referred to ; but the first time that it was explicitly mentioned was in a Chinese dictionary finished A.D. 121. However, its use to navigators was probably not generally known till the middle of the twelfth century.

In order to bring forcibly before you some of the wonderful properties of the instrument, I will arrange a needle so that its extremities will turn towards the poles.

I have here a common knitting needle about seven inches long, to which I have imparted some of that subtile, imponderable fluid or influence, generally described as magnetism.

Attached to the centre of this bar of steel is a fine silk thread by which I suspend the bar.

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It will be noted that one end immediately turns towards the North and the other towards the South.

That end towards the North is called the North pole of the needle, or more properly speaking, the North Seeking Pole, for I will show you that the kind of magnetism that is at the North seeking end of the needle is different from the magnetism which attracts it towards the magnetic North pole of the earth.

I have here another needle, similar to the one suspended before you ; this one has also the properties exhibited by the suspended one, that is, it is magnetized.

Now, upon bringing the North seeking pole of this needle towards the North seeking pole of that one which can turn freely, it is seen that the one I hold in my hand *repels* the other, and that the South end of one also repels the South end of the other ; but the North end of *either* attracts the South end of the other. Therefore the magnetism of the so-called North end of the needle is not the same as the magnetism of the North pole of the earth.

An ordinary magnetic needle costs about two dollars, but there are circumstances under which it may, and often has suddenly risen from this trifling value to the enormous sum of three or four millions of dollars.

For instance, in the case of one of our costly modern ships of war. Imagine one of these giants of the ocean cruising in a storm on a dangerous coast, the sun, moon and stars obscured by clouds and rain ; her commander unable to find anchorage must depend entirely upon that bar of steel for guidance, to save his ship and the lives of all on board.

Insignificant though the needle seems to be, there is no known substitute for it, under conditions such as I have named.

Though the value of the Magnetic Needle cannot be over-estimated, it is subject to changes, or influences, which are not perfectly understood and which at times cannot be successfully guarded against.

It is therefore necessary to use it, or to follow it, very cautiously, otherwise serious consequences might result.

The magnetic poles of the earth are not identical with its geographic

poles, and this difference which is indicated by the angle contained by the astronomic and magnetic meridians, is called the Declination of the Needle; which difference is not everywhere the same.

In this Eastern part of America the direction of Magnetic North is about sixteen degrees *West* of true North; whereas in British Columbia, it is about twenty degrees *East* of North; and this declination is continually changing, to the extent of about five minutes in a year, the North end of the needle now gradually moving towards the West, in this Eastern part of America.

It is therefore of primary importance that, before using in any section of the country, its direction be ascertained by astronomic observation.

It is likewise subject to another change, known as the diurnal variation, which deflects it from its usual course about twelve minutes in twenty-four hours, and must be taken into consideration when using it: the maximum variation occurring about 2 p.m., after which it slowly returns to its former position.

In these northern latitudes the North end of the needle is drawn downwards, the extent of the inclination varying in different locations even in the same latitude.

It has been ascertained that the North magnetic pole is situated in about latitude seventy degrees North and longitude ninety-six degrees forty-six minutes West, which is a little North West of Hudson's Bay, and not far from Chesterfield's inlet.

The *magnetic equator*, does not correspond at all points with the earth's equator, but it is a curved line, in places a number of degrees from the equator proper.

On the magnetic equator the needle remains in a horizontal position; but in southern magnetic latitudes the South end is drawn downwards in the same way that the North end inclines in northern magnetic latitude.

In order to counteract this dipping, and to keep the Needle in a horizontal position, a sliding counterpoise is placed upon most needles. *Sliding* because, as the instrument, from long use or any other circumstance, loses its magnetism, the North end dips less.

I have spoken of the changes that take place with a greater or lesser degree of regularity; there are others, sometimes very material, that cannot be accounted for and which require the constant watchfulness of the observer to detect. The greatest change of this unaccountable character, that has come under my personal observation, was a deflection of about forty-four minutes in eight or ten minutes of time. This was probably due to an electrical storm, which could not otherwise have been noticed.

The glass cover of the compass sometimes become charged with electricity, which causes the needle to *apparently stick* to the glass. This is of rather frequent occurrence. Wetting the glass immediately dispels the electricity.

Any state of the atmosphere in which electricity is an element, greatly effects the needle; electricity and magnetism being, it would seem, almost the same; the power of an electrical motor for mechanical purposes, being dependent on the magnetic force induced in iron by an electric coil surrounding it.

In many places a purely *local* attraction causes the needle to swerve from its general course, from five minutes to fourteen degrees, as noticed by myself during the twelve years I was actively engaged in surveying; and instances have been recorded where this local swerving exceeded twenty-five degrees.

These considerable deflections of the Magnetic Needle in certain localities are doubtless due to large deposits of magnetic substances. In the vicinity of Thetford and Coleraine the iron ore that is disseminated through the serpentine and so-called asbestos, attracts the needle very sensibly.

Navigators have to contend with another perplexing source of error in compass reading, which is not easily overcome, particularly in these days when iron enters so largely into the construction of ships and that iron so used sometimes effects the needle to a serious extent, and from causes that are not always apparent.

It is a well known fact that iron, remaining long in one position, sometimes becomes magnetic, and it has been found that portions of iron ships become magnetic. Now, the action of unmagnetised iron,

which at the beginning of a voyage attracted the North end of the needle, should it become magnetic, would *repel* the North end, under certain obvious conditions.

I believe it was recently discovered that the needle was influenced to a dangerous extent on a Man-of-war by the side arms of a sentry who passed near the compass and whose bayonet had become magnetised by having been stored near the ship's dynamo.

All of these irregularities of the needle may be successfully guarded against *in fair weather*, by frequent astronomic observations, but such observations require special instruments, which are not always obtainable.

In the absence of astronomic observations, the correctness of the work in hand depends upon the skill of the observer and his knowledge of the *capricious pranks*, so to speak, of this little instrument, which, with all its faults, is so marvelously useful.

With a view to increase the accuracy of compass surveys, I several years ago, invented and obtained a patent, in the United States, upon a little instrument which I called an Improvement on Transit Compasses, and it obtained considerable favor among surveyors: in fact, some of my confreres were kind enough to say that they thought that my instrument would supercede the plain sight compass.

The instrument consists mainly of a compass, rigidly attached to the upper side of a telescope turning npon trunions in a bifurcated holder. It possesses many of the advantages of the heavy and expensive transit instrument, with the lightness and inexpensiveness of the compass, and it is therefore particularly desirable for surveys in places not easily accessible.

In ordinary so-called "line running" the surveyor would only use the needle at starting, after which required points in the great circle would be accurately determined by the use of the telescope, indicated in the cut of the instrument.

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FAUNA OTTAWAENSIS.

HEMIPTERA.

By W. Hague Harrington, F.R.S.C.

During the past season insects belonging to the Hemiptera appeared to be more than usually abundant, and this seemed especially to be the case with those belonging to the division Homoptera. Many species formerly scantily represented in my collections occurred in abundance. Altogether I collected one hundred species, of which about one-fourth prove to be additions to the lists previously published. Through the renewed kindness of Mr. Van Duzee I am able to furnish a list of these, although several of the species could not be named at present. In recording these species I take the liberty of adding, in some instances, Mr. Van Duzee's remarks on the specimens. I include also three additional species of Aradus, formerly sent to Mr. Van Duzee, and referred by him to Dr. Bergroth for determination.

HETEROPTERA.

Geocoris borealis, *Dall.* Aug. 25th, Kettle Island.

Melinna modesta, *Uhl.* July 23rd, Hull ; 28th, Kettle Island.

Psallus sp. July 8th, Hull, common. "No. 9 is very common here (Buffalo). I have sent examples to Dr. Uhler, which have come back unnamed."

Plagiognathus obscurus, *Uhl.* July, 8th, Hull, two specimens.

Pilophorus amœmus, *Uhl?* July 21st.

Capsidæ sp. July 29th, Hull. New to Mr. Van Duzee.

Capsidæ sp. Aug. 18th, Kettle Island. Also new to Mr. Van Duzee.

Capsidæ sp. Aug. 18th and 25th, Kettle Island ; common. A pretty species with red markings, which has received from Dr. Uhler the ms. name of *Neoborus lætus.* "No 7, I think, has never been described ; the name was received from Dr. Uhler ; it is common here on Ligustrum."

Triphleps latulus, *Reut?* Aug. 13th.

Tripleps insidiosus, *Say*. July 21st.

Aradus tuberculifera, *Say*. Two specimens.

Aradus similis, *Say*. Three specimens.

Aradus quadrilineatus, *Say*. Two specimens.

Brachyrhynchus sp. Two young individuals taken in May under a piece of wood on the island in the Mer Bleue.

HOMOPTERA.

Thelia acuminata, *Fab*. Aug. 14th. One specimen collected in the old race-course swamp. This interesting species is said by Mr. Van Duzee to be rare at Buffalo. It has also been recorded by him as occurring at Ridgeway, Ont.

Phypia ? sp. near nava (Flata) *Say*. Aug. 5th, Russell's Grove, Hull. "No. 18 is a common form, but I cannot make it agree with any described species. It is certainly near *nava* Say."

Liburnia Osborni, *Van D*. Aug. 13th.

Pediopsis n. sp. ? "No. 27, I think, is another new species."

Tettigonia bifida, *Say*. Aug. 1st, race-course; 12th, King's Mountain; 18th, Kettle Island. A very pretty insect striped with green and black.

Platymetopius frontalis, *Van D.?* July 8th and 22nd, Hull. "No. 41 is in some doubt; it looks much larger and blacker than *frontalis* is here, but it doubtless belongs to that species."

Athysanus instabilis, *Van D*. Aug 29th, Race-course.

Phelpsius irroratus, *Say*. July 23rd, Kettle Island, two specimens.

Scaphoideus jucundus, *Prov*. July 18th, Kettle Island.

Thamnotettix n. sp. ? July 18th, Hull. "No. 40 is a very interesting form, and is probably new; I have never seen anything like it before."

Typhlocyba sp. Aug. 5th and 19th, Hull. A pretty little yellow insect, with three transversal dark bands.

Typhlocyba sp. Aug. 14th, race-course; common. A pale green form.

Typhlocyba sp. Aug. 14th and 22nd, race-course; 18th and 25th, Kettle Island; common. Prettily marked with yellow and brown.

Typhlocyba sp. July 29th, Hull. A pale yellow species.

The following notes are added on species formerly recorded :—

Scolops sulcipes, *Say*. This species was recorded on the strength of an immature form, taken some years ago at Buckingham. A specimen was taken July 21st, while sweeping the small willows along the C. A Ry. track, not far from Bank street. It is our most conspicuous example of the Fulgoridæ, and has the head produced in a long, upcurved horn.

Bruchomorpha oculata, *Newn.* This curious little insect was quite abundant during the last week of July and first week of August in borders of hay fields near Hull.

Idiocerus alternatus, *Fitch*. Very common, July and August.

Tettigonia hieroglyphica, *Say*. This pretty species was very abundant in the race-course, at Kettle Island, Hull and King's Mountain, in August.

Diedrocephala novæboracensis, *Fitch*. Very common in swamps.

Thamnotettix ruricola, *Fitch*. Also common in moist localities.

Phelpsius incisus, *Van D*. Several examples of this fine species were taken at Hull in August.

Athysanus curtisü, *Fitch*. Taken at Hull, Kettle Island and in race-course in July and August.

Neurocolpus nubilus, *Say*. Very abundant upon the flowers of Sumach on July 8th.

Gargaphia tiliæ, *Walsh*. Abundant on basswood in August.

BOTANY.

Edited by John. Craig.

Quebec Plants.—In a collection of plants sent by Mr. N. K. Berg, who has spent the past season at Shipton in the Eastern Townships, the following interesting species were found—all of which were collected in the immediate neighbourhood of Danville, P.Q. *Vicia tetrasperma*, *Impatiens paleida*, *Houstonia cærulea*, *Sparganium minimum*, *Polygonum acre*, *Carex miliaris*, *C. torta*, *C. flava*, *Poa debilis*, *Glyceria elongata*.—J.F.

Native Grasses—I have received with much pleasure a beautiful collection of the native grasses of Central Ontario, from my honoured and talented correspondent, Mrs. Catharine Parr Traill, well known as

the author of many valuable and entertaining works upon the history of pioneer life and the wild plants of Canada. This collection comprises about thirty species collected during the past summer near Lakefield, on the islands of Stony Lake, and along the shores of the Otonabee. This remarkable and untiring lover of nature is now in her ninety-third year ; but her ardour seems to be still unabated, although she naively writes :

" I was only able to go over the more important islands, not being quite as strong for climbing the rugged dangerous rocks as formerly."

Worthy of note in this collection are *Deschampsia flexuosa* from Hurricane Point and Fairy Lake, *Panicum xanthophysum* from the islands of Minni-wa-wa, *Carex sychnocephala*, with *Carex tribuloides*, from the islands in Stony Lake.

We are also pleased to announce that Mrs. Traill is just about to issue another of her charming works on natural history under the attractive title of "Pearls and Pebbles," which we feel sure will be read with pleasure and profit by many of her fellow members of this club.—J. F.

CUSCUTA EPITHYMUM, VAR. trifolii.—About the first of October of this year, I found this plant in a clover field belonging to Mr. Wm. Finley, at Ingleside, about 10 miles from St. John, N.B. Only a small patch of the field was infested with the parasite (a space not more than ten feet square), and this near the side of a road. So thick was it, however, that not only the clover stems, *(Trifolium pratense)*, but every available stalk, even to the blades of grass, were thickly twined with it. I pointed out to Mr. Finley the dangerous nature of the parasite (the first appearance so far as I am aware in the Province of New Brunswick), and he has since ploughed it under.

St. John, Oct. 22, 1894. G. U. Hay.

AN ARBORETUM FOR ST. JOHN, N.B.—In the St. John, N.B., *Globe*, under date Oct. 20, 1894, appears a letter by Mr. G. U. Hay, F.R.S.C., under the above heading. In this letter it is stated that the local Horticultural Association has been most successful during the past two years in decorating the public squares and, further, that land has been purchased for a public park. Mr. Hay then makes the following valu-

able suggestion: "Would it not be a good plan to set apart a portion of this park for an aboretum with the modest intention at first of planting there the trees and shrubs of New Brunswick?" He estimates this could be accomplished in two or three years, and points out that part of the land secured is admirably adapted for the purpose, giving a fertile piece of meadow, a swamp and rocky ground. This plan would give the park a practical value in the eyes of manufacturers, and would interest all classes; but its chief value would be from an educational standpoint. Students from the public schools could be taken there and receive practical instruction in forestry and botany. Mr. Hay concludes his letter as follows: "After the New Brunswick arboretum has become an accomplished fact, there might be added trees and shrubs from the same latitude in North America, Europe and Asia, such as may now be seen growing at the Experimental Farm, Ottawa. These would be valuable for comparison, and would serve to illustrate what trees valuable for industrial purposes could be transplanted with profit in this province.

We heartily approve of Mr. Hay's excellent suggestion and trust that he will be able to induce the local authorities to act upon it. We feel sure that the Botanical section of this Club will be pleased to do anything in their power in the way of helping with seeds and specimens, as many plants are common to both New Brunswich and Ontario.—J.F.

CONTRIBUTIONS FROM HERBARIUM OF GEOL. SURVEY OF CANADA. Can. Rec. Sc., Part I, January, 1894; Ibid, Part II, April, 1894. Montreal. (Extras.) James M. Macoun. We have just received the two parts of the above. They contain four and twelve pages, respectively, of printed matter giving interesting notes on the mode of occurrence and geographical distribution of the species which have been added to the "Flora of Canada" since the publication of Part V—"Catalogue of Canadian Plants" by Prof. John Macoun.

Not a few species and varieties have been discovered that have proved new to science. We are exceedingly pleased to see these and welcome their publication. The nature of these contributions is precisely in line with that which the members of the Council of the Ottawa Field Naturalists' Club have been desirous to publish in the OTTAWA NATURALIST. More of such contributions to Natural Science field work are needed.—H. M. A

MARINE LIBRARY MASS.

NEGLECTED POINTS.

Reprinted from the Austin, Texas, Naturalist,

If every naturalist were annually to keep a record of all that he sees, confining himself to the branch he most delights in, such proceedings would be of the greatest use both for reference in after years and for comparison with other records. All notes are useful sooner or later if properly kept, and many a little incident, trifling as it may seem at the time, might prove of great value in determining some question of the future. With the extension af settlement, animal life, in its natural state, rapidly disappears. Even is this manifest in the finny tribe, for certain species of fish which years ago abounded in some of our streams are now entirely extinct in those waters, owing to various causes attributable to man's encroachment on nature. Cutting down the forests has materially tended to cut off the old water supply, and creeks which half a century ago teemed with fish, have now dwindled to brooks with no facilities for their former inhabitants. The refuse of mills and factories has also contaminated the water, and indiscriminate slaughter, especially in spawning time, has done the rest. In the inland waters around Ottawa, Canada, several species of fish are recorded in lists published by the Natural History Society, of that place, in the year 1859, inhabiting streams which are now entirely dry; and if the records did not exist the idea of such fish having been there would be ridiculed. Records of annual observation would contribute to show the cause and the time of the extinction or driving away of certain fish. We all well know the causes to which the disappearance of land animals can be attributed, but it is not so in most cases with the denizens of the water, and I would call the attention of brother-naturalists to the importance of recording little facts for the enlightenment of those of the next generation.

The study of fish and of "animal life below the water," generally, is perhaps more neglected by the amateur naturalist than any other object, and yet it will be found, after once commencing it, most fascinating. I have often sat perfectly quiet beside a still pool or beside a shallow stream where at first no life appeared. Very soon an object darts out from under a stone or a log, either after its prey floating down,

or for sport on the gravelly bottom, or to bask in the sun. Presently others come out from out from their hiding places and a shoal of fish gather, which disappear as if by magic when a shadow is cast on the surface or a concussion by sound affects the water. Their habits and their pastimes (for fish apparently indulge in these) are very interesting. Chasing each other. darting to and fro, grubbing up the sand, rubbing against each other, and nest building (amongst some species) afford plenty of room for observation. Besides fish, other life is plentiful and affords scope for curiosity. It is astonishing what pleasure can be got out of even a shallow pool; and the writer hopes that calling attention to this will be the means of offering a new attraction in his brother-naturalists' outings.

H. B. Small, Ottawa, Canada.

MICROSCOPICAL SOIREE.

The winter course of lectures was opened by a very pleasant evening in the Convocation Hall of the Normal School, for the use of which the Club is indebted to Dr. McCabe. Arrangements had been made by the Soiree Committee, to illustrate, by a number of fine microscopes, some specially selected objects of interest. The President, Dr. Dawson, opened the meeting by a suitable address, and touched briefly on the present position of the club and the work it was performing. Prof. Saunders followed by a concise and interesting account of "A Grain of Wheat," giving a synopsis of the history, growth and structure of this very important seed. Prof. Prince introduced the subject of Zoology, and made some observations upon the development of the brain, especially in connection with that of fishes. At the close of these brief addresses, meant only to introduce the subjects which had been chosen for illustration by slides, an hour was pleasantly devoted to gazing upon the wonders revealed by the various microscopes. Besides the illustrations presided over by Prof. Saunders and Prof. Prince, the subject of entomology was taken up by Prof. Whiteaves, and was illustrated by a large series of preparations. The thanks of the Club were tendered to Mr. W. Scott, who kindly installed, for the illumination of the microscopes, a beautiful line of electric lamps.—Ed.

JUMPING BEANS; A CORRECTION.

The compositor in setting up my note on the Mexican jumping seeds unfortunately dropped three lines of the manuscript, and caused me to say "Well the exact name of the apple-worm is *Carpocapsa salitans*," and as the proof of this note (p. 125) was read hurriedly, after the rest of the November number had been revised, the error was overlooked. What I had written was as follows:—"Well the exact name of the apple-worm is *Carpocapsa pomonella*, and the motive power of the jumping bean is the grub of a near relative of the coddling-moth, which has been christened "*Carpocapsa saltitans*." The so-called "beans" also are not the seeds of the plant but the carpels. The ovary is three-celled, and each carpel contains but a single seed, which is entirely devoured by the grub, and the beans which we see are the empty carpels.—Ed.

GEOLOGY.

Edited by Dr. R. W. Ells.

The Cretaceous System in Canada. Presidential address, Section IV, Royal Society of Canada, by J. F. Whiteaves, Montreal, November, 1893. This paper gives a comprehensive resume, to date, of the various researches and results obtained in the palaeontological investigations of the Cretaceous System in Canada. The first part of the address deals with the bibliography of the subject, twelve papers having been published before 1867 by various writers: Meek, Newberry, Shumard, Hector, Bauerman, Heer, Etheridge and Gabb having contributed to the literature in question. Here Mr. Whiteaves adds that: "With the birth of the new Dominion, however, the conditions were changed, and the seventeen annual reports published since 1867, with many special publications not included therein, will abundantly show how far the new obligations imposed upon its staff have been met." Since 1867 the knowledge of the rocks and the fauna and flora entombed in them has increased from year to year, until now we find that the Cretaceous rocks of Canada are as well, if not better, described and known as the rocks of any other epoch in geology. The stratigraphical relations of the various subdivisions of the Cretaceous rocks to each other and to the overlying newer or underlying older rocks have been described by Drs.

Selwyn, G. M. Dawson, R. Bell and J. W. Spencer, also by Messrs. James Richardson, R. G. McConnell and J. B. Tyrrell. Sir William Dawson has described the flora of the Cretaceous in Canada. Mr. Tyrrell, Dr. Dawson and Dr. Rüst have published papers on the Foraminifera and Radiolaria of the same rocks, whilst the great bulk of the fauna of the Cretaceous in Canada has been carefully described, figured and published by Mr. Whiteaves, Palæontalogist and Zoologist to the Survey.

Without making a single reference to his own personal work in the elucidation and description of the fauna of the Cretaceous system of Canada, Mr. Whiteaves indicates the results thus far obtained, and sums them up as follows :—

FOSSIL PLANTS.

98	species from	Manitoba and the N. W. Territories.
52	do	the Rocky Mt. Region.
28	do	British Columbia.
1	do	the Yukon District.
179	species.	

OTHER FOSSIL REMAINS.

"Before Confederation," Mr. Whiteaves states, "only fifty-five species of fossils other than plant remains had been recognized or described from the Cretaceous of what we now call Canada, and of this number, thirty-two are from Vancouver Island and twenty-three from the North West Territories. We have now 358 species of animal remains from the undoubted Cretaceous rocks of the Dominion and 394 if we include the Laramie. They are summed up as follows :—

179	species from	Manitoba and the N. W. Territories.
13	do	the Rocky Mt. Region.
198	do	British Columbia.
7	do	the Yukon District.
394	species as the total number from Canada.	

In his work on the Cretaceous fossils of Canada, Mr. Whiteaves has described all the material brought to him by the various exploratory surveys in the great North West and the glass cases on the north side

of the National Museum on Sussex street where the type specimens are preserved, are filled with those forms of animal and vegetable life which characterized the Cretaceous epoch. These will ever be, even in themselves, a monument to the industry and perseverance of Canada's palæontologist and zoologist. H. M. AMI.

ENTOMOLOGY.

Edited by J. Fletcher.

TABANUS ATRATUS, Fab.—A fine female of this large horse-fly has been handed to me by Mr. Stephen Bresee, who took it at Sutton, Province of Quebec. It has never yet been taken at Ottawa. J. F.

DEBIS PORTLANDIA, Fab.—A fresh specimen of this pretty and rare butter-fly was taken in the woods at Kirk's Ferry, P. Q., on the 9th July last by Mr. A. P. Saunders. Mr. Saunders did not notice particularly but thinks there were other specimens flying at the same time. J. F.

THE BEE MOTH.—Early in September I noticed just outside the entrance to one (the weakest) of my seven colonies of bees a dead grub, evidently one of the troublesome and injurious bee-moth grubs. I decided at once to examine the hive, out of which it had probably come, or had been carried by the bees, and on doing so soon found abundant evidence of where the intruder had been, which was almost in the centre of one of the brood frames. The bees, however, had proved equal to the emergency, and had succeeded in dislodging their natural enemy by cutting away the cells on both sides of the frame (which at this time held brood nearly ready to hatch), and had made an opening in the comb several inches in circumference. I may add that this took place shortly after I had very materially increased the strength of the hive by putting a number of young bees in it from another colony that was particularly strong. I think that perhaps the inference from this would be that so long as colonies of bees are in good condition as regards strength, even if attacked by the bee-moth, they will themselves as a rule get rid of their enemy, which they certainly do not appear to have sufficient energy to do when in a weak state.

PERCY H. SELWYN.

MARINE BIOLOGICAL LABORATORY WOODS HOLE LIBRARY

PROGRAMME

1894—OTTAWA FIELD-NATURALISTS' CLUB.—1895.

Free Lectures on Thursdays at 8 p.m. in Normal School.

1894.

Dec. 6th. MICROSCOPICAL SOIREE.

Inaugural Address, - - - - Dr. Geo. Dawson, *F.R.S.*
A Grain of Wheat (*with illustrative sections*) - - - -
Prof. Wm. Saunders, *F.R.S.C.*
Entomology " " " J. F. Whiteaves, *F.R.S.C.*
Zoology " " " Prof. E. E. Prince, *B.A.*

Dec. 20th. GEOLOGY

How Rocks are Formed (*illustrated with microscopic sections*)
Dr. R. W. Ells, *F.R.S.C.*
Crystals (*illustrated by models*) - - W. F. Ferrier, *B.A. Sc.*

1895.

Jan. 17th. BOTANY.

From Flower to Fruit - - - J. Craig and R. B. Whyte

Jan. 31st. CONCHOLOGY.

The Present Condition of Canadian Conchology - - -
Rev. G. W. Taylor, *F.R.S.C.*
Canadian Shells - - - - - F. R. Latchford, *B.A.*
How to Collect Them - - - Prof. J. Macoun, *F.R.S.C.*

Feb. 14th. ENTOMOLOGY.

How Insects Grow - - - - James Fletcher, *F.R.S.C.*
Some Insect Works - - - W. H. Harrington, *F.R.S.C.*

Feb. 28th. ZOOLOGY.

The Cow and Her Milk - - - - Prof. J. W. Robertson
Animal Commensalism, some features of exalted Parasitism (*with illustrations*) - - - - - Prof. E. E. Prince, *B.A.*

Mch. 14th. ORNITHOLOGY.

Feathers - - - - W. A. D. Lees and A. G. Kingston

NOTE.—The Reports for each Branch will precede the reading of papers for the evening, and each paper will be illustrated as far as possible by specimens, microscopic slides or lantern. Any member who may have specimens or notes relating to the subjects under consideration is particularly requested to bring them to the meetings for discussion.

Mch. 19th. ANNUAL MEETING at 4.15 p.m.

THE PRESENT CONDITION OF CANADIAN CONCHOLOGY.

By Rev. Geo. W. Taylor, F.R.S.C.

I am afraid that the title of my paper will hardly be justified by the paper itself, for to write fully and accurately on the present state of Conchological science in our Dominion would require a greater knowledge of the subject than I can lay claim to, and would involve a much more exhaustive research into the writings of others than it has been possible for me to make ; and, moreover, the time which I understand is allotted for this paper, viz., 15 minutes, is hardly sufficient for a very elaborate treatment of any subject.

What I shall attempt this evening, therefore, will simply be to give you, as shortly as possible, a summary of what has been published up to the present time with reference to Canadian shells, and then to point out, as best I can, what still remains to be done, and the particular way in which we, as a society of Field-Naturalists, and as individual students, may help to advance this important and interesting science.

As the Dominion of Canada extends from ocean to ocean, there are at least two distinct *marine* Faunas to be studied. There are also the very numerous *land* and *freshwater* mollusca, some confined to our eastern provinces, some to the western, while others range through the length and breadth of our territories.

No naturalist, except our fellow member the accomplished Zoologist to the Geological Survey of Canada, (Mr. Whiteaves), seems to have given special study to the subject of Canadian mollusca as a whole, and so for convenience sake I will in this paper divide my remarks into 3 parts, and will take

(1.) The marine mollusca of the Atlantic Coasts.

(2.) Those of the Pacific Coast.

(3.) The land and freshwater shells of the Dominion.

Of necessity I must omit all reference to that very important part of conchology which treats of our fossil shells, and, in order to keep my paper within proper limits as to length, I will reserve bibliographical details for an appendix, in which I will try to enumerate all the most important papers that have appeared bearing upon our subject.

BIOLOGICAL WOODS HOLE

1. *Marine Mollusca of the Eastern and Northern Coasts of Canada.*

Many excellent treatises on the Zoology of the Bay of Fundy have been written, some by United States, and some by Canadian Naturalists. The boundary line between Canada and the Northern United States is, however, in no sense a zoological one, and consequently we shall find that the publications of the United States naturalists dealing with New England mollusca are of great service in the study of the fauna of New Brunswick and Nova Scotia.

First among such publications must be mentioned Stimpson's Marine Invertebrata of the grand Manan [2] (1854). In this classic work 117 species of molluska are enumerated, all of which may be expected to be found (and the majority have already been found) in New Brunswick waters.

Next comes Gould's "Invertebrata of Massachusetts." In the original edition (1841), no references are made, I think, to Canadian localities, though many of our shells are noted and described, but in the second edition, (1870), edited and much enlarged by Dr. W. G. Binney, such references are frequent and the work is one that is almost indispensible to Canadian conchologists.

Prof. Verrill has written many papers of much importance to us.—'On the invertebrata of Vinyard Sound,' [12] 'On Dredging Expeditions on the Coast of New England,' [13] 'On recent additions to the Marine Invertebrata of the North-Eastern Coast of America,' [14] (several papers). 'On the Cephalopods of the North-Eastern Coast of America,' [18] and so forth.

All these papers contain notices of Canadian localities, and most interesting notes on the habits and the nomenclature of our shells.

The above mentioned authors, though incidentally dealing with our mollusca, wrote with special reference to the United States Coasts, but the writer next referred to views the subject from a purely Canadian standpoint.

Mr. W. F. Ganong has several valuable papers in the Bulletins of the Natural History Society of New Brunswick. One paper, 'On the Zoology of the Invertebrate animals of Passamaquoddy Bay,' [21] was

published in the Bulletin (No. IV,) for 1884. A second, 'On Marine Invertebrata of L'Etang Harbour,' [22] in Bulletin V in the next year.

A third, and much more important paper [23] appeared in the Bulletin (No. VI), for 1886. This last contains the complete list of the Marine Mollusca of New Brunswick, (the Northern waters, Northumberland Straits and Bay Chaleur, are considered as well as Bay of Fundy), so far as it could be compiled at that date from the works of previous writers and from the author's own observations. The introduction contains much useful information and a full bibliography of the subject up to 1887.

Nearly 200 species are noticed in this paper, and additions to the list are made in Mr. Ganong's "Zoological Notes," [25] published in the same series of Bulletins in 1890. Other papers by Ganong [24] and Winkley [26] are also published in these useful Bulletins and should be consulted.

For information regarding the Mollusca of the Gulf of St. Lawrence we must refer to the work of Mr. Whiteaves. His papers, of which four [9-11] on this branch of the subject are noted below, contain accounts of his own deep-sea dredgings, and though published more than 20 years ago are still most valuable, containing almost all we know of the shells of these waters. There are, however, other papers by Bell,[3] Dawson [5] and Packard, [7] that may be consulted with advantage.

I may also refer here to an interesting little note in the Report o the Geological Survey for 1878-9, on marine shells collected in the Hudson's Bay by Dr. Bell [19] who, I believe, collected additional marine specimens when with the Hudson's Bay Expedition in 1884, but no record of these has yet been published so far as I know.

Altogether from 200 to 250 species* are noted, in the works I have referred to, as inhabiting the waters of our Atlantic coasts. No complete list of these has, however, been attempted, and for my own part I have to confess that my knowledge of eastern Canadian conchology is very imperfect. I have never enjoyed an opportunity of studying the eastern shells at home and am not well acquainted with the literature.

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*Note—Exactly 240 names are contained in a manuscript list that I lately prepared for my own information.

It is very probable, therefore, that I have omitted some references of importance. It is probable too that some of you may be able to supply the omissions, in which case I shall be very grateful.

II. *Marine Mollusca of the Pacific Coast of Canada.*

Passing now to the consideration of our western Marine shells I feel that I am on more familiar ground, for in the course of a residence of nearly 10 years in British Columbia I have been able to pay considerable attention to the study of the objects themselves and to the published observations of others.

As a starting point a student will naturally take the well known work of Dr. Carpenter, "The Mollusks of Western North America."[27]

This work is invaluable and is so thorough that though it was published 30 years ago, and though many naturalists have collected on the coast since Carpenter's day, only 81 marine species have been added to the list he gives of the B. C. mollusca.

Mr. Whiteaves has done much to extend our knowledge of western shells by the publication of four valuable papers. Three contain reports on collections made by Mr. James Richardson[29] and Dr. Geo. M. Dawson,[30-31] for the Geological Survey, at Victoria, Queen Charlotte Islands, and in various localities to the north and west of Vancouver Island.

These papers are still procurable and should be in the hands of every Canadian conchologist. The collections referred to are all on view in the museum of the Survey at Ottawa.

Last year Dr. C. F. Newcombe, of Victoria, compiled a very useful list of B. C. marine shells,[34] containing references to all Carpenter's and Whiteaves' localities and adding many others from his own very extensive observations. Dr. Newcombe also gives in the same paper a list of more than 100 works referring in some way to our western shells.

Still more recently there is a paper written by myself[36] and presented to the Royal Society of Canada, in May, 1894, and now being printed, in which is summarized all that I could write on the mollusca of western Canada. In this, the latest, I believe, contribution to western Canadian conchology, 284 marine species are enumerated. Thirty-two of these species appear also on eastern list.

III. *Land and Freshwater Shells of Canada.*

So much has been written on the land and freshwater shells of Canada that it will be impossible for me to mention here all of the many useful papers that have appeared.

In the eastern provinces the writing of D'Urban,[47, 48, & 56] Bell,[49] Whiteaves,[51, etc.,] Provancher,[73] Hanham,[79] and others have almost exhausted the subject.

Of the rich fauna of the Ottawa district we have accounts from the pens of Heron[60] and Latchford,[61, etc.,] the last named I hope still hard at work.

Passing westward we find that Manitoba has been explored conchologically by Bell[57], Dawson[59] and Christy[71].

The mollusca of Alberta have been studied by myself in collections most kindly made for me by Mr. A. O. Wheeler and Mr. T. E. Bean, and which will be reported on in an early number of the OTTAWA NATURALIST. Forty-four species are now known to me from that province.

There is a short paper on shells from the Rocky Mountains in the *Nautilus* for December 1893.[80]

Finally for information as to the land and freshwater shells of our most western province (B.C.) I must refer you to my own paper on the land shells in the OTTAWA NATURALIST[63] (December, 1889), to a revised list of the same in the *Nautilus* December, 1891,[76] and to a list of fresh-water species which is contained in my paper above referred to on the marine shells of B.C.

A preliminary check list of the land and freshwater shells of the whole Dominion, containing 244 names, was published in the OTTAWA NATURALIST for June 1892.[66]

This list may be brought fairly well up to date by omitting (as erroneous records or as synonyms) *Sph. patella*, *Sph. lenticulum*, *Pisid. occidentale* and 3 unnamed Pisidia, *Anod. angulata* and *ovata*, *Pomatiopsis lustrica*, *Limnæa emaginata*, *Physa triticea*, *Planorbis macrostomus* and *Billingsii*, and *Somatogyrus isogonus*, and by adding the following: *Sph. fabale* Prime and *Raymondi* J. G. Cooper, *Pis. aequilaterale* Prime, *Unio parvus* Barnes, *Novi-eboraci* Lea and *circulus* Lea, *Bythinella*

tenuipes Couper, *Somatogyrus subglobosus* Say, *Pleurocera pallidum* Lea, *Goniobasis translucens* Anthony and *Haldemani* Tryon, *Limnæa reflexa* Say, *Nuttalliana* Lea, *pallida* C. B. Adams, *galbana* Say and *bulimoides* Lea., *Physa vinosa* Gould, *Bulimus hordaceus* Lea, *Planorbis ammon* Gould and *dilatatus* Gould, *Ancylus fuscus* C. B. Adams, *Selenites Voyana*, Newcombe, *Limax flavus* Linn, *Arion fuscus* Müller, *Mesodon exoletus* Binney, *Triodopsis fallax* Say, *Pupa Blandi* and *Succinea Grosvenori* Lea. When these alterations have been made, our amended list will contain 258 names.

As will be seen from this very superficial review, the *literature* of Canadian Conchology is already quite voluminous. A student, however, needs something more than literature. To a beginner no aid is so acceptable as that offered by a well arranged museum.

I think we have a right to expect that in this respect our own national museum should supply all we can require. In this expectation, however, we shall be disappointed. The eastern marine shells are represented in the museum at Ottawa by a very incomplete series. The western collection, though very much better, is almost useless to the student who attempts to study it by himself, as in nearly all cases the names of the specimens are on the bottoms of the boxes containing them and consequently concealed from view. I am speaking of course of the collection as I saw it last, 16 months ago.

It must be pointed out that this defective labelling need not be a hindrance to any one really anxious to study the collection, as Mr. Whiteaves is always ready (at least this has been my experience) to open the cases for a bona fide student, and at the same time to give him the benefit of his own vast fund of information.

As to the land and freshwater shells in the Ottawa Museum there are very few indeed on exhibition. Though the officers of the Geological Survey have travelled through the length and breadth of the Dominion and collected extensively in many localities, the specimens they have brought together are still for the most part un-reported on, or at any rate the records are unpublished, and the specimens themselves are stored away in private cabinets and rooms.

I am perfectly aware that there is no space in the present museum

BIOLOGICAL LAB. WOODS HOLE

for the proper display of all the collections and I am therefore not reflecting on those who are in charge, but I may be permitted to express a hope that the day is not far distant when in a new museum building there will be provided adequate space for the proper exhibition of all our national collections.

The museums of McGill College and of the Natural History Society of Montreal I am sorry to say I have never seen, but they contain, I know, some valuable collections and together they must possess, I should think, the most complete series of Canadian shells in Canada.

Smaller collections are contained in the museums of the New Brunswick Natural History Society (at St. John) and the Provincial Government of B.C. at Victoria, the former collection being principally of eastern and the latter of western marine shells.

Of private collections of shells there are only very few. I am not acquainted with any conchologist possessing a collection of Canadian Atlantic shells in any sense complete. Of Pacific shells I know only of the collections of Dr. Newcombe and myself, both nearly perfect as to native species. Of land and freshwater shells of Canada it is probable that the collections of Messrs Latchford, Hanham, and myself (all members of the O.N.F.C.) are the most complete, and I am sure that I am right in saying that these collections will all of them be freely placed at the service of students wishing to make use of them.

Now though much has been done towards ascertaining the species of mollusca occurring within our limits, and towards working out their distribution within our territory, and studying their habits and life histories, there is still much to be done before our knowledge of the Conchology of Canada can be considered at all satisfactory. The labourers in the field have been so few that there thousands of square miles of land and hundreds of miles of sea coast still wholly unexplored.

The deep seas of both the Atlantic and Pacific Coasts have as yet hardly been touched. The Nudibranchs of both the eastern and western seas have been almost wholly neglected. The land and freshwater shells of large tracts of our western and northern provinces are quite unknown. Even in those provinces that have been most thoroughly worked, *i.e.* Ontario and Quebec there are, I am confident, many dis-

coveries to be made, and of course in the less known districts in the northern and western portions of the Dominion there must be numbers of species which will one day be brought to light by the industrious naturalist. Moreover there are the life histories of the great majority of our species still to be worked out.

In many genera, too, the limits of variation of the various species have yet to be defined. I do not suppose that any two conchologists would be agreed as to the number of species, of such genera, for instance as *Limnæa* or *Planorbis* or *Sphærium* or *Pupa* or *Succinea* or *Bela* or *Macoma*, which should be entered upon our lists; and the same state of things obtains of course in many other genera.

Our first desideratum is I think a *larger number of observers.* The area to be examined is so extensive that, until in Canada we can count at least ten times as many conchologists as there are at present, we cannot hope to have the field properly covered.

Secondly, with a view to encourage or stimulate a rising generation of students, I think we ought to try and secure a more *complete National collection* of mollusca and their shells.

If proper space could be given at Ottawa to such a collection I am sure that it would be considered a pleasure and a privilege by Canadians to be allowed to make the collection as perfect as might be.

And thirdly, I think we need a *geographical catalogue* of the mollusca of Canada showing the distribution of the species as at present known. This might be on the same plan as Prof. Macoun's well known Catalogue of Plants, and I am sure that it would prove a very great help to collectors and students. Such a catalogue could, I should fancy, be prepared quite easily at the present time by the officers of the Geological and Natural History Survey from the data already in their possession.

And now in concluding this very hasty and imperfect survey of the subject, I will ask the members of the club to do what they can towards supplying the desiderata I have indicated.

Try to send a few more students into the field. Try to impress upon the officers of our National Museum the need of as complete a representation of the *recent*, as there is already of our *fossil*, conchological fauna, and if you agree with me that the time has come when our

shells should be catalogued as our beasts and birds and plants have already been, then try to persuade the Naturalists in charge of our public collections to undertake the work which I feel they will most readily do, if they think that such a course will help forward the study of Canadian conchology.

Appendix.

A list of some of the most important papers relating to Canadian Conchology:

A. Papers referring more especially to eastern marine shells.

1. Stimpson, Wm.—Revision of the Synonymy of the Testaceous Mollusks of New England. Boston, 1851.

2. Stimpson, Wm.—Synopsis of the Marine Invertebrata of Grand Manan or the region about the mouth of the Bay of Fundy, New Brunswick.
Smithsonian Contributions, Vol. vi., 1854.

3. Bell, Robert—On the Natural History of the Gulf of St. Lawrence, and the distribution of the Mollusca in Eastern Canada.
Canadian Naturalist, Vol. iv., p. 197. June, 1859.

4. Gould, A. A.—Report on the Invertebrata of Massachusetts, comprising the Mollusca, Annelida and Radiata, &c. Cambridge, 1841.
Second edition revised and enlarged by W. G. Binney. Boston, 1870.

5. Dawson, J. W.—Marine Invertebrates collected in Gaspe Bay, lat. 48°, 45′ W.
Canadian Naturalist, Vol. iii., No. 5, p. 329. October, 1858.

6. Carpenter, P. P.—Note on Mullusks and Radiates from Labrador.
Canadian Naturalist, Vol. iv., No. 2. April, 1859.

7. Packard, A. S.—On the Marine Invertebrata of Southern Labrador.
Canadian Naturalist, Vol. viii, No. 6. p. 401. December, 1863.

8. Stimpson, Wm.—Review of the Northern Buccineas, and remarks on some other Northern Marine Mollusks.
Canadian Naturalist, Vol. ii, new series. October, 1865.

9. Whiteaves, J. F.—On the Marine Mollusca of Eastern Canada.
Canadian Naturalist, Vol. iv., new series, p. 48-57. March, 1869.

9*a*. Whiteaves, J. F.—Lower Canadian Marine Mollusca.
Canadian Naturalist, Vol. v., new series. July, 1870.

10. Whiteaves, J. F.—Report on Deep-Sea Dredging operations in the Gulf of St. Lawrence. (And two subsequent reports.)
Report to Minister of Marine and Fisheries. Ottawa, 1874. [Pamphlet.]

11. Whiteaves, J. F.—On recent Deep-Sea Dredging operations in the Gulf ot St. Lawrence.
American Journal of Science, 3rd series, Vol. vii., p. 210 &c. March, 1874.
Reprinted in *Canadian Naturalist*, new series, Vol. vii., p. 336. Nevember, 1894.

12. Verrill, A. E.—Report upon the Invertebrate Animals of Vinyard Sound and the adjacent waters, &c.
In the Report of the U. S. Fish. Commission for 1871-2. Washington, 1873.

13. Verrill, A. E.—Results of recent Dredging Expeditions on the Coast of New England.
Americon Journal of Science, 3rd series, Vol. v. January, 1873.

14. Verrill, A. E.—Notice of Recent Additions to the Marine Fauna of the Eastern Coast of North America.
American Journal of Science, 3rd series, Vol. xvii. April, 1879.

15. Verrill, A. E.—Notice of Recent Additions to the Marine Invertebrata of the North-eastern Coast of America.
Proc. U. S. Nat. Museum, Vol. iii., p. 356. 1880.

16.—Verrill, A. E.—Notice of Recent Additions to the Marine Invertebrata of the North-Eastern Coast of America.

Proc. N. S. Nat Museum, Vol. v., p. 315. 1882.

17. Verrill, A. E.—Catalogue of the Marine Mollusca added to the Fauna of the New England Region during the past ten years.

Trans. Conn. Acad., Vol. v., p. 447. April-July, 1882.

18. Verrill, A. E.—The Cephalopods of the North eastern Coast of America.

Trans. Conn. Acad., Vol. v., June, 1880 and August, 1881.

19. Bell, Robert.—Report on Hudson's Bay, &c., &c.

Appendix, "List of the Land, Freshwater and Marine Mollusca collected."

Report of Prog. Geo. Surv. Canada, 1879-80. Montreal. 1881.

20. Bain, F.—The shells of Prince Edward Island.

Canadian Science Monthly, March, 1885.

21. Ganong, W. F.—On the Zoology of the invertebrate animals of Passamaquoddy Bay.

Bulletin of Nat. Hist. Soc. of New Brunswick, No. 5, pp. 87-97, 1885.

22. Ganong, W. F.—Notes on the Marine Invertebrates of L'Etang Harbour and the neighbouring waters.

Bull. N. H. Soc. N.B., No. 5, pp. 34-36, 1885.

23. Ganong, W. F.—On the Marine Mollusca of New Brunswick with a list of species.

Bull. N. H. Soc, N.B., No. 6, pp. 17-61, 1887.

24. Ganong, W. F.—The economic Mollusca of Acadia.

Bull. N. H. Soc. N.B., No. 8, pp. 3-116, October, 1889

25. Ganong, W. F.—Zoological Notes.

Bull. N. H. Soc. N.B., No. 9, pp. 46-49, 1890.

26. Winkley, W. H.—Mollusca of the Oyster Beds of New Brunswick.
Bull. N. H. Soc. N.B., No. 7, pp. 69-71, 1888.

B. Papers referring to western marine shells.

27. Carpenter, P. P.—The Mollusks of Western North America.
Smithsonian Miscellaneous Collections 252.
Washington, December, 1872.

28. Lord, J. K.—The Naturalist in Vancouver's Island and British Columbia.
In 2 Vols. London 1866.

29. Whiteaves, J. F.—On some Marine Invertebrata from the west coast of North America.
Canadian Naturalist, N.S., Vol. viii, December, 1878,

30. Whiteaves, J. F.—On some Marine Invertebrata from the Queen Charlotte Islands.
Report, Pro. Geo, Surv. Canada, 1878-79. Montreal, 1880.

31. Whiteaves, J. F.—Some Marine Invertebrata collected by Dr. G. M. Dawson on the coast of British Columbia.
Trans. Roy. Soc. Canada Vol. iv., sec. 4. 1886.

32. Whiteaves, J. F.—Notes on some Marine Invertebrata from the coast of British Columbia.
Ottawa Naturalist, Vol. vii, pp. 133-137. December, 1893.

33. Newcombe, C. F.—Preliminary Check list; Marine shells of British Columbia.
Victoria 1893 (pamphlet.)

34. Newcombe, C. F.—Report on the Marine shells of British Columbia.
Bull. N. H. Soc. of Brit. Columbia, 1893, p. 31.

35. Taylor, G. W.—Notes of a collecting trip to Departure Bay, Vancouver Island.
Nautilus Vol. vii., p. 100. January 1894.

C. Papers relating to the land and freshwater shells of Canada.

37. Sheppard, Mrs.—On the Recent shells which characterize Quebec and its environs.

Trans. Lit. and Hist. Soc. Quebec Vol. iv, p. 188. 1829.

38. Gould, A. A.—Catalogue of shells with descriptions of new species in Agassiz "Lake Superior."

Boston 1850.

39. Binney, W. G.—Catalogue of land and freshwater univalve Mollusks collected in British America by Messrs Rose, Kennicott, and Drexler.

Proc. Acad. Nat. Sci. Phila., 1861, p. 330.

40. Chapman, Ed. J.—Some notes on the drift deposits of western Canada and on the ancient extension of the Lake area of that region.

Canadian Journal, 1861.

41. Chapman, Ed. J.—Additional note on the occurrence of freshwater shells in the upper drift deposits of western Canada.

Canadian Journal, 1861.

42. Dawson, J. W.—On the newer Pliocene and Post Pliocene Deposits, of the vicinity of Montreal, with notices of Fossils recently discovered in them.

Canadian Naturalist, Vol. ii., No. 6. December 1857.

43. Billings, E.—Notes on the Natural History of the Mountain of Montreal.

Canadian Naturalist, Vol. ii., No. 2, p. 92. May 1857.

44. Anonymous.—Descriptions of some of the Freshwater Gasteropoda inhabiting the Lakes and Rivers of Canada.

Canadian Naturalist, Vol. ii., p. 185. July 1857.

45. Dawson, J. W.—Additional Notes on the Post Pliocene Deposits of the St. Lawrence Valley.

Canadian Naturalist, Vol. iv., No. 1 February 1859.

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46.—Bell, Robert.—Notes on the Natural History of the Gulf of St. Lawrence and the distribution of the Mollusca of Eastern Canada.

Canadian Naturalist, Vol. iv., p. 197. 1859.

47. D'Urban, W. S. M.—Observations on the Natural History of the Valley of the River Rouge and surrounding Townships in the Counties of Argenteuil and Ottawa.

Canadian Naturalist, Vol. iv. 1859.

48. D'Urban, W.S.M.—Addenda to Natural History of the Valley of the River Rouge.

Canadian Naturalist, Vol. vi. 1861.

49. Bell, Robert.—On the occurrence of Freshwater Shells in some of our Post Tertiary deposits.

Canadian Naturalist, Vol., vi. 1861.

50. Bell, Robert.—List with notes of recent Land and Freshwater shells collected around Lakes Superior and Huron in 1859-60.

Canadian Naturalist, Vol. vi. 1861.

51. Whiteaves, J. F.—On the Land and Freshwater Mollusca of Lower Canada with thoughts on the general geographical distribution of animals and plants in Canada.

Canadian Naturalist, Vol. vi. 1861.

52. Whiteaves, J. F.—On the Land and Freshwater Mollusca of Lower Canada.

Canadian Naturalist, Vol. viii. February and April, 1863.

53. Whiteaves, J. F.—Lower Canadian Land and Freshwater Mollusca.

Canadian Naturalist, new series, Vol. v. July, 1870.

54. Bell, Robert.—On the Fauna of portions of the Lower St. Lawrence, the Saguenay, Lake St. John, etc.

Rept. Prog. Geo. Surv. Canada, 1857. Toronto, 1858.

55. Bell, Robert.—Catalogue of Animals and Plants collected by Mr. R. Bell on the South East side of the St. Lawrence, from Quebec and Gaspé.

Rept. Prog. Geo. Surv. Canada. 1858. Montreal, 1859.

56. D'Urban, W. S. M.—Catalogue of animals collected by Mr. D'Urban in the Counties of Argenteuil and Ottawa.

Rept. Prog. Geo. Surv. Canada, 1858. Montreal, 1859.

57. Bell, Robert.—List of Freshwater Mollusca from Manitoba and the Valley of the Nelson River.

Rept. Prog. Geo. Surv. Canada, 1878-79. Montreal, 1880.

58. Bell, Robert.—See No. 19.

59. Dawson, Geo. M.—Report on the Geology and Resources of the region in vicinity of the Forty-ninth Parallel, *app. E.* Land and Freshwater Mollusca, collected during the summers of 1873-74 in the vicinity of the 49th par. Lake of the Woods to the Rocky Mountains. Montreal, 1885.

60. Heron, G. C.—On the Land and Freshwater Shells of the Ottawa.
Trans. Ottawa F. N. Club, Vol. i., pt. 1, pp. 36-40. 1880.

61. Latchford, F. R.—Notes on the Ottawa Unionidæ.
Trans. Ottawa F. N. Club, Vol. i., pt. 4, pp. 48-57. 1892.

62. Latchford, F. R.—Observations on the Terrestrial Mollusca of Ottawa and vicinity.
Trans. Ottawa F. N. Club, Vol. ii., p. 211-231. 1885.

63. Taylor, Geo. W.—The Land Shells of Vancouver Island.
OTTAWA NATURALIST, Vol. iii., p. 84-94. December, 1889.

64. Taylor and Latchford.—List of the Land and Freshwater Mollusca of Ottawa as recorded in the Transactions of the Ottawa Field-Naturalists' Club up to April 1, 1890.

OTTAWA NATURALIST, Vol. iv., p. 54-58. June, 1890.

65. Latchford, F. R.—Conchological Notes.

OTTAWA NATURALIST, Vol. vi., p. 118-119. November, 1892.

66. Taylor, G. W.—Preliminary Check List of the Land and Freshwater Mollusca of Canada.

OTTAWA NATURALIST, Vol. vi., p. 33-37. June, 1892.

67. Taylor, Geo. W.—Conchological Notes (Pupa Holzingeri).

OTTAWA NATURALIST, Vol. vii., p. 51. June, 1893.

68. Latchford, F. R.—Conchological Notes (H. rufescens, &c.)

OTTAWA NATURALIST, Vol vii., p. 132. November, 1893.

69. Taylor, G. W.—A Planorbis new to the Ottawa List.

OTTAWA NATURALIST, Vol. viii, p. 161. January, 1894.

NOTE.—Nine reports of the Conchological Section of the Ottawa Field-Naturalists' Club have been published in the Translations, Vol. i., p. 57 and 74; Vol. ii., p. 130, 263 and 350, and in the OTTAWA NATURALIST, Vol. i., p. 107; Vol. iii., p. 65; Vol. iv., p. 51 and Vol. viii., p. 97.

70. Latchford, F. R.—Shells of Anticosti.

American Naturalist, Vol. xviii., p. 1051-2. October, 1884.

71. Christy, R. M.—Notes on the Land and Freshwater Mollusca of Manitoba.

Journal of Conchology, Vol. iv., p. 339-349. July, 1885.

72. Taylor, John W.—Description of a New Species of Planorbis from Manitoba.

Journal of Conchology, Vol. iv., p. 351. July, 1885.

73. Provancher, L'Abbe L.—Les Mollusques de la Province de Quebec.
Quebec, 1891.

74. Cockerell, T. D. A.—New Western Slugs.
Nautilus, Vol. iii., pp. 111-113, February, 1890.

75. Cockerell, T. D. A.—The Slugs of British Columbia.
Nautilus, Vol. v., pp. 30-32, July 1891.

76. Taylor, G. W.—Land shells of Vancouver Island.
Nautilus, Vol. v., p. 91, December, 1891.

77. Taylor, G. W.—Limax Agrestis, Linn., on the Pacific coast.
Nautilus, Vol. v., p. 92, December, 1891.

78. Nutting, C. C.—Report on Zoological explorations on the Lower Saskatchewan River.
Bull. Labr. of Nat. Hist. of the State Univ. of Iowa. Vol. ii., No. 3., p. 235.

79. Hanham, A. W.—Land Mollusca observed in the Gaspe region.
Nautilus, Vol. vii., p. 65, October, 1893.

80. Taylor, Geo. W.—Land and freshwater shells in the Rocky Mountains.
Nautilus, Vol. vii, p. 85-86. December, 1893.

NOTE:—Dr. W. H. Dall's very useful pamphlet, "Instructions for collecting Mullusks and other useful hints for the Conchologist" was published in 1892 as part G of Bulletin No. 39 of the U.S. National Museum. It should be in the hands of every one taking up the study of shells, and it contains in addition to full instructions for the collection and preservation of specimens, figures of the necessary apparatus and a list of the most useful text books &c.

BOOK NOTICES.

"*The Lower Silurian Lamellibranchiata of Minnesota.*" By E. O. Ulrich. From Vol. III of the final report of the Geol. and Nat. Hist. Survey of Minnesota ; pp. 475–628, June 16, 1894.

This interesting contribution to the palæontology of the Cambro-Silurian or Ordovician Rocks of Minnesota contains many things of interest to Canadian geologists. Several of the forms therein described or referred to, occur in Canada or are closely related to Canadian species, whilst the discussion of their generic relations is always a topic of special interest to all palæontologists. This memoir constitutes chapter VI of the third volume of the final report of the Minnesota Survey and opens out with a short excursus on the terminology used in the text. The following forms occur in Canada and are described in the text and figured under the following designations.

1. *Ambonychia bellistriata*, Hall.
2. " *amygdalina*, Hall.
3. Byssonychia radiata, Hall (sp.)
   (=Ambonychia radiata of authors.)
4. Modiolopsis mytiloides, Hall.
5. Cyrtodonta rugosa, Billings.
6. " Canadensis, Billings.
7. Vanuxemia inconstans, Billings.
8. Matheria tenera, Billings.
9. Whitella Hindei, Billings,
   (=Cyrtodonta Hindei, B.)
10. " plebeia, Billings.
    (=Cyrtodonta plebeia, B.)
11. Ctenodonta nasuta, Hall.
12. " " var. robusta, Ulrich.
13. " gibberula, Salter.
14. " levata, Hall.
15. " Logani, Salter.

Genus Whiteavesia.—On page 513 of this memoir Prof. Ulrich proposes the genus *Actinomya* to receive a number of species heretofore classed under the general designation of *Modiolopsis*. The name

Actinomya was preoccupied by Meyer. On page 628 Mr. Ulrich says:—"A new name is therefore necessary for the Silurian genus, and it gives me much pleasure to propose *Whiteavesia*, after Prof. J. F. Whiteaves the successful palæontologist to the Geological Survey of Canada.

H. M. AMI.

WHITEAVES, J. F.—*Descriptions of two new species of Ammonites from the Cretaceous rocks of the Queen Charlotte Islands. Can. Rec. Sci. pp. 421–426, Pl. VII, figs. 1, 1 a, and 2, 2 a, and 2 b. Montreal, October, 1893.*

As the title indicates, Mr. Whiteaves here described two new species of Ammonites from British Columbia. The precise locality from which the specimens are said to have been collected is Skidegate Inlet, Q. C. I.

These specimens were communicated to Mr. Whiteaves, by Dr. C. F. Newcombe of Victoria, B.C., curator of the Natural History Society of British Columbia, but were collected at Skidegate by Mr. James Deans, formerly assistant to the late Mr. James Richardson of the Geological Survey of Canada, who visited those Islands in 1872.

The two species described by Mr. Whiteaves are as follows:—

Pl. VII, figs. 1, 1 a. Olcostephanus (Astieria) Deansii; Pl. VII, figs. 2, 2 a, 2 b. Hoplites Haidaguensis. These two forms, which as Mr. Whiteaves says "are clearly referable to the family of Stephanoceratidæ of Neumayr," are "nearly related" to two other forms from "the Neocomian of France" viz: *Olcostephanus Jeannotti* d'Orbigny, sp., and *Hoplites sinuosus*, d'Orbigny, sp., respectively. An excellent plate accompanies the paper, prepared by Mr. Laurence Lambe, and drawn on stone by Mr. O. E. Prudhomme.

H. M. AMI.

CONTENTS.

NOTE.—Vol. VIII consists of 10 Nos., none having been issued in January and February.

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1878. P. lapathifolium, L. (Dock leaved Persicaria.)

P. nodosum, Pers. Macoun, Cat. III, 409.

Low ground. Aug.—1. Sheaths and bracts not ciliate. Spikes short, erect or nearly so. Peduncles with scattered sessile glands.

1879. ———————— var. incarnatum, Watson.

P. incarnatum, Ell. Macoun, Cat. III, 409.

Low, rich ground. Not uncommon. Aug.—1. A tall, coarse plant sometimes four feet high, with long leaves and nodding, slender, spikes of pale pink flowers.

1880. P. Pennsylvanicum, L.

Low, rich ground. Common. Aug.—1. (B) A tall handsome species with conspicuous flowers. Easily recognisable by the stalked glands on the peduncles.

1882. P. amphibium, L. (Water Persicaria.)

In shallow water. Common. Aug.—1. (B) Flower spike erect, terminal, borne above the water from the centre of two or three floating leaves.

1884. P. Hartwrightii, Gr.

P. amphibium, L. var *terrestre*, Auct.

In ditches and at the sides of streams and ponds. Not uncommon. Aug.—1. This species has been, until lately, confounded with *P. amphibium* and *P. Muhlenbergii*, Watson. It differs from the former in its habit of growth and the nature of the inflores cence. In this species and *P. Muhlenbergii* the flowers are borne in a slender elongated spike. *P. Hartwrightii* has foliaceous and ciliate sheaths. These characters are lacking in *P. Muhlenbergii*, which, however, is rough, with appressed hairs all over.

1885. *P. Persicaria*, L. (Lady's Thumb.)

In cultivated and waste ground. Common. July—2. (B) Leaves usually blotched, sheaths fringed, peduncles without glands, spikes short and thick.

1886. *P. Hydropiper*, L. (Common Smartweed.)

Low ground. Annual. Aug.—2. (B) Whole plant smooth. Flowers greenish, tipped with pink, spikes nodding.

1887. P. acre, H B K. (Water Smartweed.)

Low ground. Rare. Billings Bridge. Aug.—1. Perennial.

Spike slender, erect, terminal. Flowers whitish. Sheaths covered with rusty hairs. The sepals of this and the last species are dotted with conspicuous glands.

1888. P. HYDROPIPEROIDES, Mx. (Mild Water-Pepper.)

In water and wet places along streams. Billings Bridge. Casselman. Hull. Aug.—1. Perennial. Stem smooth, weak, branching. Sheaths hairy. Flowers white in erect spikes. Sepals not dotted.

1890. *P. orientale*, L. (Prince's Feather.)

A garden escape. A tall, handsome annual with dense cylindrical spikes of large rose-coloured flowers. Billings Bridge. Aug.—2.

1895. P. ARIFOLIUM, L. (Halberd-leaved Tear-thumb.)

Swamps. Lake Flora. Mer Bleue. July—2. (B) Leaves large, long-petioled. Peduncles glandular, bristly.

1896. P. SAGITTATUM, L. (Arrow-leaved Tear-thumb.)

Low ground and along streams. Much commoner than the last. July—2. (B) Leaves short-petioled. Peduncles smooth.

Both of these last-named plants are annuals, with weak stems, beset on the angles with sharp, reflexed prickles, by means of which they support themselves amongst the low herbage where they grow.

1897. *P. Convolvulus*, L. (Black Bind-weed. Wild Buckwheat.)

An introduced and troublesome weed throughout the Dominion. June—4. Seeds black, dull.

1898. P. CILINODE, Mx. (Hairy-jointed Bind-weed.)

Sandy and clayey banks. Not uncommon. Aug.—1. (B) A rather attactive plant, with deeply-veined leaves. Stems red, climbing. Flowers white, in panicled racemes. Seeds smooth and shining.

1899. P. DUMETORUM, L. var. SCANDENS, Gray. (Climbing False Buckwheat.)

Climbing over bushes. Township of March *(A. H. Moore)*. Chats Rapids. Rare. Aug.—1. Seed smooth and shining.

FAGOPYRUM, Tourn. Buckwheat.

1900. *F. Tartaricum*, L. (Rough Buckwheat.)

An accidental introduction. Billings Bridge. Stewarton. July

—3. This plant differs from *F. esculentum* in having smaller greenish flowers and a wrinkled seed.

1901. *F. esculentum*, Mœnch. (Common Buckwheat.)

Introduced. Common. Aug.—1.

RUMEX, L. Dock.

1904. R. OCCIDENTALIS, Watson.

Swamps. St. Louis Dam. Lake Flora. Hull. July—1. A tall species. Valves of the seed rounded, heart-shaped, without exterior grain like tubercles.

1906. R. BRITANNICA, L. (Great Water-Dock.)

R. orbiculatus, Gray.

Swamps and beside streams. Malloch's Bay. Hull. Mer Bleue. Aug.—2. Tall and stout, with a contracted panicle. Seed-valves round-ovate, all grain-bearing.

1907. R. SALICIFOLIUS, Weinmann. (White Dock.)

Introduced here from the west. Waste lot on Albert street. Several plants. July—2. This dwarf species is easily recognised by its pale, almost glaucous, narrow leaves and copious yellowish fruit. Seed-valves deltoid-ovate, with one, two, or sometimes all three, bearing a large grain.

1908. R. VERTICILLATUS, L. (Swamp Dock.)

River sides and ditches. Rather uncommon. Billings Bridge. Skead's Mill. Hull. Templeton. June.—3. (B) The lower whorls of flowers distant. Fruit-bearing pedicels elongated, three to four times longer than the calyx, abruptly reflexed. Seed valves each bearing a large grain.

1909. *R. crispus*, L. (Curled Dock.)

Introduced. Common by roadsides and in cultivated ground. June—3. (B) Easily recognised by the waved margin of the leaves. Seed-valves round-heart-shaped, mostly grain-bearing. Much used as a pot herb.

1910. *R. obtusifolius*, L. (Bitter Dock. Dairymaids' Dock.)

Introduced. Much rarer than the last. Rifle Range. Billings Bridge. Gatineau Point. July—2. Seed-valves ovate-halberd-shaped, with three to five large lateral teeth towards the base. This is the best dock for removing the pain of nettle stings.

1912. R. MARITIMUS, L. (Golden Dock.)

River bank. Rare. Green's Creek *(A. H. Moore)*. New Edinburgh *(H. M. Ami)*. Hull *(Prof. Macoun)*. Aug.—2. A low plant, with crowded, leafy, compact spikes of yellow fruit. Seed-valves spear-shaped, with two long teeth on each side and a large grain on the back.

1913. *R. Acetosa*, L. (Common Sorrel.)

Occasionally introduced with grass seed; but not persistent. Billings Bridge. Hintonburgh. July—2. Diœcious. Seed-valves grain-bearing, enlarging as the fruit ripens.

1915. R. ACETOSELLA, L. (Sheep Sorrel.)

Abundant in sandy soil and exhausted fields. July—1. Diœcious. Seed-valves ovate, scarcely enlarging in fruit, not grain-bearing.

ARISTOLOCHIACEÆ.

ASARUM, L. Asarabacca.

1916. A. CANADENSE, L. (Wild Ginger.)

Rich woods. Common. May—4. (B) A charming plant, with its rich purplish brown, three-cleft flower, borne low on the ground beneath the leaves, in the axil of the two delicate green, pubescent, kidney-shaped leaves. The fleshy root is aromatic, when broken smelling like ginger.

PIPERACEÆ.—Pepper Family.

SAURURUS, L. Lizard's Tail.

1918. S. CERNUUS, L.

In shallow water. In great abundance along the Nation River at Casselman. July—3. This is the only station so far recorded in this part of Canada.

THYMELEACEÆ. Mezereon Family.

DAPHNE, L.

1921. *D. Mezereum*, L. (Mezereon.)

Rocky woods. Near Hemlock Lake, Beechwood. (Mrs. Chamberlin.) Ap.—4. Introduced, but well established. The beautiful pink or white fragrant flowers opening before the leaves. Followed by scarlet berries.

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DIRCA, L. (Leather wood. Moose-wood.)

1922. D. PALUSTRIS, L.

Rich woods. Ap.—4. (B) The small yellow tubular flowers, 3 or 4 in number, produced early in spring from buds enclosed in dark brown hairy scales. Leaves oval, short-petioled, pale green. Bark fibrous and very tough, much used in the woods instead of twine.

ELÆAGNACEÆ. Oleaster Family.

SHEPHERDIA, Nutt.

1924. S. CANADENSIS, Nutt.

Rocky woods. May—1. (B) A straggling diœcious shrub with yellow flowers opening before the leaves. The leaves and young shoots covered with brown peltate and white stellate hairs.

SANTALACEÆ. Sandal-wood Family.

COMANDRA, Nutt. Bastard Toad-Flax.

1928. C. UMBELLATA, Nutt.

Dry rocky woods. Rockcliffe. Hull. King's Mountain. May —4. (B) A low herb with pale green oblong leaves and a terminal corymbose cluster of white flowers. Parasitic on the roots of shrubs. I have traced the connection of the roots with those of *Prunus Virginiana* and *Viburnum pubescens* to which they were attached by an enlarged cone-shaped disk.

EUPHORBIACEÆ. Spurge Family.

EUPHORBIA, L.

1935. E. MACULATA, L.

Sandy fields. Common. July—2. (B) Annual.

1939. *E. Helioscopia*, L. (Sun Spurge.)

Introduced. Roadsides and gardens. July—3. (B) The centres of the flower-clusters yellow. Pods smooth. Annual.

1940. *E. Cyparissias*, L.

Perennial. A garden escape. July—1. Stems densely clustered. Stem-leaves linear crowded.

1941. *E. Peplus*, L. (Horned Garden Spurge.)

Introduced. Border of field, Green's Creek. Parliament Hill. Aug.—2. Annual. Horns of the 4-lobed involucrum long. Lobes of the pod 2-wing-crested on the back.

ACALYPHA, L. Three-seeded Mercury.

1945. A. Virginica, L.

Low ground in shade. July—4. (B) An inconspicuous weedy plant with green flowers and long-petioled leaves.

URTICACEÆ. Nettle Family.

ULMUS, L. Elm.

1946. U. fulva, Mx. (Red Elm. Slippery Elm.)

Rocky woods. Ap.—4. (B) Flowers almost sessile. Branches wide-spreading, with the leaves towards the tips of the branchlets. Buds and branchlets downy.

1947. U. Americana, L. (White Elm. Swamp Elm.)

Low woods. Ap.—4. (B) Our most beautiful forest tree. Flowers on drooping pedicels. Buds and branchlets glabrous.

1948. U. racemosa, Thomas. (Rock Elm. Corky White Elm.)

Rocky woods. May—1. (B) A small tree in this district; but very large in Western Ontario. Easily distinguished by the corky ridges on the branches and the racemed flowers.

These three are the only elms we have in Canada, notwithstanding the various local names.

CELTIS, L. Nettle Tree.

1949. C. occidentalis, L. (Sugar-berry. Hackberry.)

River banks. Rare. Billings Bridge. Malloch's Bay. Britannia. May—1.

A rather small forest tree with the appearance of an Elm. Leaves sharply serrate, reticulated, ovate-lanceolate taper-pointed oblique at base and asymmetrical. Flowers green, axillary, peduncled. The fertile flowers solitary or in pairs; the staminate flowers fascicled along the base of the branchlets.

HUMULUS, L. Hop.

1950. H. Lupulus, L. Wild Hop.

Not indigenous in this locality. River side. Hull. Billings Bridge. June—4.

CANNABIS, L. Hemp.

1951. *C. Sativa*, L. (Hemp.)

Introduced into Canada as a fibre-plant. Very common in waste places. July—1. (B)

URTICA, L. Nettle.

1954. U. GRACILIS, Ait. (Common Nettle.)

Low ground. July—1. A tall slender species sometimes growing 10 feet in height. Stinging hairs few. (B)

LAPORTEA, Gaudich. Wood Nettle.

1959. L. CANADENSIS, Gaudich.

Low woods. Common. July—1. A graceful plant with large pale, alternate, serrate leaves and conspicuous diœcious flowers. Whole plant covered with rigid stinging hairs.

PILEA, Lindl. Clearweed.

1960. P. PUMILA. Gray. (Richweed.)

Low cool woods and around springs. July—1. (B) A small, smooth and pellucid annual, without stinging hairs.

BŒHMERIA, Jacq. False Nettle.

1961. B. CYLINDRICA, Willd.

Low woods and thickets. July—1. A taller plant than the last with more of the appearance of a nettle; but stringless. (B)

JUGLANDACEÆ. Walnut Family.

CARYA, Nutt. Hickory.

1964. C. ALBA, Nutt. (Shell-bark Hickory.)

River side. Rare. A few trees at Casselman and at Deschenes Rapids. June.

1967. C. AMARA, Nutt. (Bitter-nut Hickory.)

Rocky woods. Hull. Billings Bridge. June.

JUGLANS, L. Walnut.

1968. J. CINEREA, L. Butternut.

Rocky woods. Common. June—1. One of the grandest of our forest trees. (B)

MYRICACEÆ. Sweet-gale Family.

MYRICA, L. Wax Myrtle.

1970. M. GALE, L. (Sweet Gale.)

In Peat-bogs, along the borders of lakes. Common in its proper habitat. The diœcious flowers precede the leaves. Whole plant strongly aromatic. May—2.

1973. M. ASPLENIFOLIA, Endl. (Sweet Fern.)

Comptonia asplenifolia, Ait. Gray's Man. 458.

Sandy and clayey woods. Ironsides. Aylmer. Ap.—4. Local. A pretty aromatic shrub, 1—2 feet high, with fern-like linear-lanceolate leaves six inches in length, which are pinnatifid with many rounded lobes.

CUPULIFERÆ. The Oak Family.

BETULA, L. Birch.

1974. B. LENTA, L. (Cherry Birch. "Black Birch.")

B. excelsa of Aiton.

Rich woods. May—1. (B) A large forest tree with thick bark, which is smooth and dark brown, like that of the cherry, when the tree is young. Fruiting catkins oblong-cylindrical, over an inch in length, the scales short with divergent lobes.

1975. B. LUTEA, Michx, f. (Yellow Birch. Gray Birch.)

B. excelsa of Pursh.

Low rich woods. May—1. Bark of trunk yellowish or silvery-gray, hanging in thin filmy layers. Fruiting catkins oblong-ovoid, under an inch in length, the scales thinner than in No. 1974, twice as large with narrower, barely spreading, lobes.

1977. B. PAPYRIFERA, Mx. (Paper Birch, Canoe Birch.)

B. papyracea, Ait. Gray's Man. 459.

Woods and river banks. May—1. (B) Leaves ovate.

1979. B. PUMILA, L. (Low Birch. Swamp Birch.)

Peat bog. Mer Bleue. Rare. May—4. A small shrub, with erect branches, not glandular; young branches and roundish leaves soft-downy when young.

ALNUS, Gærtn. Alder.

1985. A. INCANA, Willd. (Common Swamp Alder.)

Borders of streams and swamps. Ap.—2. (B) Usually our first plant to flower. This and *Acer dasycarpum* always preceding all others. The catkins which (of both sorts) were formed the previous summer, flowering long before the leaves expand.

LOGICAL

1986. Alnus viridis, DC. (Green Alder.)

Along the rocky banks of the Gatineau. Flowers appearing after the leaves.

CARPINUS, L. (Hornbeam.)

1987. C. Caroliniana, Walter. (Blue Beech.)

C. Americana, Michx.

Low woods. May—3. A small tree with very smooth gray bark.

OSTRYA, Scop. (Iron-wood.)

1988. O. Virginica, Willd, (Iron-wood. Hop-Hornbeam.)

Rich woods, May—3. A small but very beautiful tree when growing in the open, somewhat resembling the last, but with rough bark. (B.)

CORYLUS, L. (Hazel-nut.)

1989. C. rostrata, Ait. (Beaked Hazel-nut.)

Thickets and open woods, May—1. (B.)

QUERCUS, L Oak.

1994. Q. macrocrapa, Michx. (Mossy-cup Oak. Over-cup Oak.)

A fine tree, extremely variable in all its parts. The various forms occurring here seem much nearer to the so-called Var. *olivæformis* than to the type. All the Ottawa "White Oaks" belong to this species.

1998. Q. rubra, L. (Red Oak.)

A magnificent tree, with smooth gray bark and spreading branches. Cup saucer-shaped or flat, of fine closely appressed scales. This is apparently the only "Red Oak" we have at Ottawa.

FAGUS, Tourn. Beech.

2003. F. ferruginea, Ait. (American Beech.)

A fine forest tree found in rich woods. The bell-shaped flowers are borne in drooping clusters, and are very beautiful.

SALICACEÆ.—The Willow Family.

SALIX, Tourn. Willow, Osier.

2005. *S. alba*, L. var. *cærulea*, Smith. (European Willow.)

Introduced. This Prof. Macoun tells me is the large European willow which is cultivated as a shade tree in the French portions of the city. The different varieties are described in Gray's Manual, sixth edition, p. 481.

2010. S. BALSAMIFERA, Barratt. (Pear-leaved Willow.)

S. pyrifolia, Anders.

Peat bogs and mountain sides. Rare. Mer Bleue, by the Gas Spring. King's Mountain, west slope (*J.F.*) Patterson's Creek, (*J. M. Macoun*,) Young leaves thin, of a rich reddish colour, afterwards pale green above and glaucous beneath, long-petioled, rigid. Capsules glabrous.

2012. S. CANDIDA, Willd (Hoary Willow. Red-flowered Willow.)

A beautiful bush with silvery leaves found in peat bogs. Leaves lanceolate to linear lanceolate, margins revolute, downy above and densely so below Styles and anthers crimson. Young shoots and capsules densely tomentose

2015. S. CORDATA Muhl. (Heart-leaved Willow.)

A very variable species. Leaves on young vigorous shoots, rounded or cordate at base, on flowering shoots tapering; green both sides, soon becoming smooth Stipules reniform or ovate, serrate, usually large. Sterile catkins. with a few bracts at base, fertile leafy-peduncled, rather slender, 2-3 inches long. Capsules long-pedicelled smooth, (B). Vicinity of Ottawa (*J. Macoun*) The Little Chaudière and along the Gatineau (*J. F*)

—— var. ANGUSTATA, Gray. (Narrow-leaved Willow)

"This variety includes those forms with long narrow leaves, which, were it not for the fruit, would be considered quite distinct from *S cordata*. (*J. Macoun*.) Islands above Chaudière, (*B. Billings*.)

2016. S. DISCOLOR, Muhl. (Glaucous Willow)

Our most abundant and earliest willow. A large bush, leaves smooth, glaucous beneath. Flowers large and showy, appearing before the leaves. (B.)

—— var. ERIOCEPHALA, Anders.

Catkins more densely-flowered and more silky. St. Louis Dam. Ironsides, Billings Bridge.

2024. S. HUMILIS, Marshall. Prairie Willow.

A low shrub, varying much in the size and shape of the leaves. Leaves oblanceolate, distinctly petioled, downy above, beneath glaucous, rough-veined and softly tomentose, the margin revolute,

Catkins ovoid, closely sessile, appearing before the leaves, curved. Dry woods. Hog's back, and on the Island in the Mer Bleue, (*J F.*)

2027. S. LONGIFOLIA, Muhl (Long-leaved Willow.)

A pretty, low, shrub, growing along river banks on rocks, on sand, or in mud. July—1. Not common. Leaves long and narrow, tapering to each end, nearly sessile, sometimes very silky. Catkins appearing late, singly or in small clusters, at the tips of the slender branchlets.

2028 S LUCIDA, Willd. (Shining Willow.)

One of our most ornamental species, forming a large close bush, with polished yellow twigs, and large dark green glossy leaves. The showy flowers appear late in spring, on short leafy branchlets. Common in ditches and swamps. (B.)

2029. S. MYRTILLOIDES, L. (Myrtle-like Willow. Bog Willow.)

A low shrub found in peat-bogs with entire coriaceous leaves, glaucous beneath. Capsules reddish green. Mer Bleue, near the gas spring. June—1.

2030. S NIGRA, Marsh. (Black Willow.)

A tree or shrub. Leaves long and narrowing from near the base to the usually curved tip, closely serrate. Catkins long and slender, borne on short lateral leafy branchlets in summer. June—3.

2039 S PETIOLARIS, Smith. (Gray Willow.)

Sandy river banks, common. Leaves narrowly lanceolate, taper-pointed, finely and evenly serrate; only slightly silky when young; stipules linear or semi-cordate. Catkins sessile, or in fruit slightly peduncled. Capsules silvery-silky.

2040. S. PURPUREA, L. (Purple Osier-Willow.)

Introduced from Europe. A loose straggling shrub, with long, erect purplish branchlets. Leaves oblanceolate, very smooth, glaucous. Billings Bridge, (*H. M. Ami.**)

1041. S. ROSTRATA, Rich. (Livid Willow.)

Our commonest willow. A large, loose shrub. Leaves dull green and downy above, heavily veined and soft-hairy beneath; obovate, irregularly serrate. Catkins appearing with the leaves. Capsules tapering to a very long slender beak; scales pale, rose-tipped, linear, thinly villous. (B)

2049. S. VIMINALIS, L. (Osier Willow.)
Introduced. New Edinburgh.

POPULUS L. Poplar.

2053. P. TREMULOIDES, Michx. (American Aspen.)
A small tree with white bark. One of the first trees to expand its flowers in the spring. The young leaves glabrous, and of a delicate yellowish green. Ap.—3. (B.)

2054. P. GRANDIDENTATA, Michx. (Large-toothed Aspen.)
A rather larger tree than the last, with smooth green bark and having the young leaves densely covered with white silky hairs, afterwards almost smooth, roundish-ovate, with large and irregular teeth. May—1. (B.)

2055. P. BALSAMIFERA, L. (Balsam Poplar. Balm of Gilead.)
A large, handsome tree, bearing heart-shaped leaves, and large buds covered with an aromatic resin. Petioles round, capsules 2-valved. Ap.—4. (B.) Of the var. *candicans*, Gray, Dr. Gray (Manual 6th Edn., 1890, p. 487,) says, "*Leaves broader and more or less heart-shaped*; petiole commonly hairy. Common in cultivation, but rare or unknown in a wild state;" But Prof. Macoun says (Macoun Cat. VI, p. 45), that this variety seems to be the prevailing form in Ontario.

2058. P. MONILIFERA, Aiton. (Cottonwood.)
A grand tree growing on islands or by river-sides, sometimes over 100 feet high, easily distinguished from the last by the elongated, flattened petioles, and the necklace-like fruiting catkins of 3-4-valved, capsules. May—2.

—— *P. dilatata*, Ait. (Lombardy Poplar.)
Introduced. A tall stiff tree of very rapid growth, largely cultivated in some parts for "ornament."

—— *P. alba*, L. (Silver Abele. White Poplar.)
Introduced. A handsome tree, but troublesome from its habit of spreading from the roots. The far more beautiful *P. Bolleana*, from Eastern Europe, has not this habit, but is also, for a poplar, exceptionally difficult to propagate from cuttings.

MASS.

CERATOPHYLLACEÆ.—Hornwort Family.

CERATOPHYLLUM, L. Hornwort.

2061. C. DEMERSUM, L.

Abundant in slow waters. Growing entirely under water. Leaves whorled, sessile, cut into thrice-forked threadlike rigid divisions. Flowers monœcious, axillary and sessile.

CONIFERÆ.—The Pine Family.

THUYA, Tourn. Arbor Vitæ.

2962. T. OCCIDENTALIS, L. (White Cedar.)

Swamps and rocky banks. (B.)

JUNIPERUS, L. Juniper.

2067. J. VIRGINIANA, L. (Red Cedar. Pencil Cedar.)

A small tree in this locality. On both sides of the Ottawa river, but not abundant. May—3.

2068. J. COMMUNIS, L. (Common Juniper.)

A low spreading elegant shrub. Dry and sandy fields. May—3.

2069. J. SABINA, L. var. PROCUMBENS, Pursh. (Creeping Savin.)

A dark green prostrate shrub. Rocky banks at the Chaudière, on both sides of the river.

TAXUS, L. Yew.

2071. T. BACCATA, L. var. CANADENSIS, Gray. (American Yew. Ground Hemlock.)

T. Canadensis, Willd.

A low, straggling bush, growing in wet woods. May—4. (B.)

PINUS, L. Pine.

2072. P. STROBUS, L. (White Pine. Weymouth Pine.)

A magnifficent tree and Canada's pride. Leaves 5 in a fascicle.

2076. P. RESINOSA, Aiton. (Red Pine. "Norway Pine.")

A beautiful tree at all stages of growth. Leaves 2 in a fascicle, 5-6 inches long. June—2.

2081. P. BANKSIANA, Lambert. (Jack Pine. Scrub Pine.)

A small tree of little value. Leaves 2 in a fascicle, $1\frac{1}{2}$ to 2 inches long. Cones conical, usually curved, smooth and very hard, persistent on the branches for several years. Two trees only have

been observed near Ottawa, one found on King's Mountain, Chelsea, P.Q., by the late Mrs. J. G. Bourinot, and the other at Eastman's Springs. June—1.

PICEA, Link. Spruce.

2082. P. NIGRA, Link. (Black Spruce.)

Abies nigra, Poir.

A small tree found in swamps and mountain woods. Branchlets pubescent, foliage purplish glaucous; cones small, ovate, in this locality less than an inch in length, persistent, growing on the branchlets, generally recurved, and frequently in clusters, purple when young. June—2.

—— var. RUBRA, Engelm. (Red Spruce.)

"Differs from the type, in having darker and larger leaves; larger, bright red-brown cones, which (are borne nearer the tips of the branchlets, and) are more readily deciduous after maturity." (*Engelmann.*) In peat bogs. Casselman, (*J.F.*) Eastman's Springs, (*J. Macoun.*)

2083. P. ALBA, Link. (White Spruce.)

Abies alba, Poir.

A most beautiful forest tree, sometimes forming a steeple-like cone over 100 feet in height. Branchlets glabrous; leaves slenderer than in 2082, of a much brighter green, or in a variety occurring at Rockcliffe, of a beautiful glaucous white, almost equalling the celebrated Colorado Blue Spruce (*Picea pungens.*) of the West. Cones cylindrical, from 1-2 inches in length, pendulous from the tips of small branchlets, deciduous, green when young, pale brown when mature.

TSUGA, Carr. Hemlock.

2086. T. CANADENSIS, Carr. (Hemlock.)

Abies Canadensis, Michx.

A magnificent tree, whether viewed as the hoary giant which has withstood the winter blasts of centuries, or the young tree which has not yet formed a trunk, when in spring as the young foliage is pushing forth from the tips of the pendulous branchlets, and numberless slender twigs, it can only be likened to a living fountain, every spray of which is tipped with golden green. Foliage dark green above, silvery beneath.

ABIES, Juss. Balsam Fir.

2090. A. BALSAMEA, Miller. (Canada Balsam Fir.)

A slender tree, found in swampy woods. Cones large, oval-cylindrical, 2-4 inches long, borne erect on the upper side of spreading branches, frequently in dense masses at the tops of the trees. Leaves sessile, flat, on vigorous apical shoots scattered and bottle-brush-like as in *Picea*; but 2-ranked on the horizontal branches. Foliage very aromatic.

LARIX, Mill. Larch.

2094. L AMERICANA, Michx. (Tamarack. Black Larch.)

A slender, graceful tree with valuable timber, growing in peat bogs. Strangely called "Juniper" in the Maritime Provinces. June—1.

ENDOGENS.

HYDROCHARIDACEÆ.—Frog's-bit Family.

ELODEA, Michx. Water-weed.

2108. E. CANADENSIS, Michx.

Anacharis Canadensis, Planchon.

Abundant in all slow waters. The remarkable flowers of this and the next are well worth examining by all botanists.

VALLISNERIA, L. Eel-grass.

2209. V. SPIRALIS, L. (Water Celery.)

Abundant in lakes and rivers.

ORCHIDACEÆ.—Orchid Family.

MICROSTYLIS, Nutt.

2210. M. MONOPHYLLOS, Lindl.

Peat-bogs. Rare. Dow's Swamp. Mer Bleue. Hull. La Pêche. Raceme long and slender, the pedicels short. June—3.

2211. M. OPHIOGLOSSOIDES, Nutt.

In similar places as 2210. Rare. Dow's Swamp. Eastman's Springs. Aylmer. July—2. Raceme conglomerate at summit of scape.

LIPARIS, Richard. Twayblade.

2213. L. Lœselii, Richard.

Peat-bogs, hummocks in swamps, and particularly on stumps and floating logs in the Rideau Canal, not uncommon. A small, greenish flowered orchid, bearing 2 leaves, and a single scape from a solid bulb. June—2.

CALYPSO, Salisb.

2214. C. borealis, Salisb.

On mossy hummocks in shady woods. Rare and of very uncertain appearance. Billings Bridge, abundant in 1878, not since found (*J.F.*) Beechwood, 1888. High Falls, above Buckingham, Q. 1892 (*R. B. Whyte.*) May—3

APLECTRUM, Nutt. Putty-root.

2215. A. hyemale, Nutt. (Adam and Eve.)

Rich wood. Beechwood. Very rare. (*Lt.-Col. White**) June—3

CORALLORHIZA, R. Br. Coral-root.

2216. C. innata, R. Br.

Shady swamps and woods. Rather rare. Dow's Swamp. Hull. Mer Bleue. May—4. Whole plant yellow.

2218. C. multiflora, Nutt.

Rich woods. Beechwood. Clark's Wood. Chelsea. Kingsmere. Rare. July—2. Plant purple, lip white, spotted.

2220. C striata, Lindl. (Macrae's Coral root.)

C. Macraei, Gray.

Rich wood. Very rare. Found once at Beechwood by Mrs. Chamberlin, and once since at Kingsmere A most beautiful plant, bearing about 20 large, bell-shaped flowers on a stout stem; whole plant white, striped with deep crimson. July—1.

SPIRANTHES, Richard Ladies' Tresses.

2224. S. Romanzoffiana, Chamisso.

Wet Meadow. East Templeton (*Wm. Scott.*) Only found in the above locality, where it is in great profusion. Beak of stigma 2-horned, short. July—3.

2225. S. cernua, Rich.

Peat-bog. Lake Flora, Hull. Very rare. Spike slenderer than in 2224; leaves longer and narrower. Beak of stigma long and very slender. Sep.—1.

2226. S. GRACILIS, Bigelow.

Hummock at edge of swamp. Blue-berry Point, Aylmer. Very rare. July—2. Spike very slender and twisted, leaves ovate, lying on the ground.

GOODYERA, R. Br. Rattlesnake Plantain.

2227. G. REPENS, R. Br.

Cool woods. Not uncommon. July—3. Scape short, 4-8 inches. Flowers white, in a one-sided tapering spike.

2228. G. PUBESCENS, R. Br. (Larger Rattlesnake Plantain.)

Rich woods. Hull. Ironsides. Kingsmere. July—4 Rarer than 2227. The flowers are of a purplish white, in a shorter, more obtuse, crowded spike, not one-sided. Scape higher. Leaves larger, less white-reticulated.

ARETHUSA, L.

2230. A. BULBOSA, L. Arethusa.

Peat-bogs. Rare, but occasionally found in large numbers within restricted localities. Mer Bleue. July—1. A beautiful plant bearing one large erect rose purple flower, usually without a leaf from a solid bulb. (In one locality with pink flowers like *Pogonia ophioglossoides.*)

CALOPOGON, R.Br.

2231. C. PULCHELLUS, R. Br. (Beautiful Bearded-Orchis.)

Peat-bogs. In enormous profusion in the Mer-Bleue and at Lake Flora, Hull. Dow's Swamp, rare. July—1. A lovely Orchid bearing 5 or 6 large pink-purple flowers, on a slender scape, with a single grass-like leaf. (B.)

POGONIA.

2232. P. OPHIOGLOSSOIDES, Ker. (Scented Pogonia.)

Peat-bogs. With the above and in the same profusion. A lovely plant with one (or 2) large flowers at the summit of a slender scape which bears a single lance-oblong leaf near the middle and a rather large bract at the base of the large pink flower.

The flowers of this and the last are most interesting and are well worth examining by the botanist.

ORCHIS, L. Orchis.

2235. O. SPECTABILIS, L. (Showy Orchis.)

Rich shady woods. Not uncommon. June—1. Root thick and

GICAL ... ODS HOLE ... BRARY

fleshy. Leaves 2, one pointed at apex, the other blunt. Flowers 4 or 5 pink-purple with a pure white (rarely purple) lip. (B.)

2238. O. ROTUNDIFOLIA, Gray. (Round-leaved Orchis.)

Habenaria rotundifolia, Rich.

Peat-bogs. Rare. Dow's Swamp. July—2. Root slender, creeping. Scape slender, bearing one large, almost round, leaf at the base, and a few whitish flowers at the summit, lip spotted with reddish purple.

HABENARIA, Willd. Rein Orchis.

2239. H. TRIDENTATA, Hook.

Peat-bog. Very rare. Two specimens were found at the same time, in a tiny bog at Black Lake, high up on King's Mountain, Chelsea, P.Q. July—2. Not since found although closely looked for in our many peat-bogs.

2240. H. VIRESCENS, Spreng.

Marsh, in shade. Thurso, Aug.—1 (*Wm. Scott**.)

Leaves large and thin, oblong lanceolate, passing into the conspicuous bracts of the elongated raceme. Flowers very small, green. Sepals half the length of the slender spur.

2241. H. BRACTEATA, R. Br. (Bracteate Green Orchis.)

H. viridis, R. Br. var. *bracteata*, Reich.

Woods and meadows. Not uncommon. Twin-bulbs palmate; flowers green, bracts long and conspicuous. May—3.

2243. H. HYPERBOREA, R. Br.

Peat-bogs and swamps. June—1. Flowers green. (B.)

2246. H. DILATATA, Gray. (Wild Hyacinth.)

Peat-bogs. Not common. June—2. Stem leafy, leaves narrow spike dense, elongated. Flowers white, scented. (B.)

2252. H. HOOKERI, T and G.

Damp and rocky woods. Hull. Beechwood. Chelsea. Common. June—2. Leaves orbicular; lying flat on the ground; flowers green, spur tapering to the tip.

——var. OBLONGIFOLIA, J. A. Paine.

With the above and perhaps hardly worthy of a varietal name. Leaves oblong.

2253. H. ORBICULATA, Torr. (Large Round-Leaved Orchis.)
Rich woods. Kingsmere. Rockcliffe. Beechwood. Rare. July—1. Leaves large lying flat on the ground, silvery beneath. Raceme large, lax; flowers greenish white, spur long, enlarged at the tip.

2255. H. BLEPHARIGLOTTIS, Torr. (White Fringed-Orchis.)
Peat-bog. Mer-Bleue, July—3. Flowers pure white. Rootstock small for the genus, not much swollen.

2258. H. PSYCODES, Ray. (Small Fringed-Orchis.)
Peat-bogs and Swamps. Common. July—3. Raceme crowded, elongate-cylindrical, flowers pink-purple, fragrant. (B.)

2359. H. FIMBRIATA, R Br (Large Fringed-Orchis.)
Bogs and Swamps. Rare. Eastman's Springs, Kingsmere (*J.F.*) Blanche River, Templeton (*H. M. Ami.*) July—1. Whole plant larger than 2258 and flowering two weeks earlier. Flowers fewer in a looser spike, lilac-purple with a white eye. Buds orbicular.

CYPRIPEDIUM, L. Lady's Slipper.

2260. C. ARIETINUM, R. Br. (Ram's-head Orchis.)
Dow's Swamp. Very local. May—4. Flowers purple and white. Easily recognized by the remarkable resemblance of the flowers to a ram's head in profile.

2261. C. PARVIFLORUM, Salisb. (Smaller Yellow Lady's Slipper.)
Peat-bogs. Not uncommon. May—4. Flowers bright yellow and deep purple.

2262. C. PUBESCENS, Swartz. (Larger Yellow Lady's Slipper.)
Rocky woods. Local but abundant. Chaudière woods on both sides of the river. It is difficult to find good points of distinction between this and the last. Both are scented, both vary in the shape of the lip and the brightness of the yellow. On the whole *pubescens* has larger flowers, irrespective of the size and vigour of the plant, the sepals are paler in colour and it grows in drier locations. June—1. (B.)

2263. C. SPECTABILE, Salisb. (Showy Lady's Slipper.)
Peat-bogs. Common. July—1. This is probably our most beautiful wild flower, but is gradually disappearing from ruthless digging up of the roots. (B.)

2264. C. ACAULE, Ait. (Stemless Lady's Slipper.)

Peat-bogs. Local. Beechwood (*Dr. H. B. Small**). Lake Flora, Hull (*J. F.*) Casselman (*Wm. Scott*). May—4.

IRIDACEÆ.—Iris Family.

IRIS, L. Flower-de-Luce. Fleur de Lis. Flag.

2269. I. VERSICOLOR, L. (Blue Flag.)

Low ground. Common. June—1. (B.)

2271. I. TENAX, Dougl.

Swampy wood on the banks of the Gatineau, Hull, P.Q. The plant so named by Dr. George Vasey, was one of two growing together, the leaves were slender and grass-like, less than ¼ inch wide, the flowers less than half the size of 2269 and of a deeper purple.

SISYRINCHIUM, L. Blue-Eyed Grass.

2275. S. ANCEPS, Cav.

Low ground. June—1. Scape 6-18 inches high, branched, bearing 2 or more peduncled spathes, bract less elongated. Seeds small, rough. (*Wm. Scott.*)

2276. S. ANGUSTIFOLIUM, Mill. (Gray's New Manual, 1890.)

Low ground. June—1. The same as *S. mucronatum* Mx. and *S. Bermudiana*, L. var. *mucronatum*, Gray, of the old Manual.

LILIACEÆ.—The Lily Family.

SMILAX, L. Green-brier.

2283. S. HERBACEA, L. (Carrion-Flower.)

Moist woods and banks of streams. Common. June—2. Flowers green, fetid; Berries black, glaucous, in round clusters on very long peduncles. (B.)

ASPARAGUS, L.

2284. A. OFFICINALIS, L. Garden Asparagus.

An escape from cultivation. June—1.

POLYGONATUM, Adans. Solomon's Seal.

2285. P. BIFLORUM, Ell.

Rich woods. May—2. (B.)

STREPTOPUS, Mx. Twisted-Stalk.

2287 S. AMPLEXIFOLIUS, DC.

Swampy woods. Kingsmere. Casselman. Very rare. May—4. Flowers greenish white. Leaves glabrous, glaucous beneath. Stigma entire.

2288. S. ROSEUS, Mx.

Woods. May—2. Flowers rose-purple. Leaves green both sides, finely ciliate at the edges. Stigma 3-cleft. (B.)

SMILACINA, Desf. False Solomon's Seal.

2289. S. STELLATA, Desf.

Moist banks and thickets. May—4. Leaves 6 to 12 running up close to the few-flowered raceme. (B.)

2291. S. RACEMOSA, Desf. (False Spikenard.)

Rich woods. Not common. Billings Bridge. Hull. Chelsea. Beechwood. May—4. Flowers in a terminal panicle. (B.)

2293. S. TRIFOLIA, Desf.

Swamps. June—2. Leaves 2 or 3, glabrous. Raceme peduncled.

MAIANTHEMUM, Wiggers.

2294. M. CANADENSE, Desf. (Wild Lily of the Valley.)

Smilacina bifolia, var. *Canadensis*, Gray.

Moist woods. May—2.

ALLIUM, L. Onion. Garlic.

2300. A. TRICOCCUM, Ait. (Wild Leek.)

Rich open woods. Uncommon. Leaves large 8 inches long by 2 wide, dying down before the flowers open in July.

2303. A. CANADENSE, Kalm. (Wild Garlic.)

On a small island above Billings Bridge. May—3. Leaves narrowly linear.

LILIUM, L. Lily.

2313. L. PHILADELPHICUM, L. (Wood Lily.)

Rocky woods. McKay's Woods. Hull. Aylmer. July—1. (B.)

ERYTHRONIUM, L. Dog's-tooth Violet.

2320. E. AMERICANUM, Smith (Yellow Adder's-tongue.)

Open woods. May—2. (B).

UVULARIA, L. Bell-wort.

2334. U. GRANDIFLORA, Smith (Wood Daffodil.)

Rich woods. Common. May—1. (B). Variable in size and colour of the flowers.

OAKESIA. Watson.

2334. O SESSILIFOLIA, L

Uvularia sessilifolia, L.

Woods and banks. Common. May—3. (B)

CLINTONIA, Raf.

2341. C. BOREALIS, Raf.

Damp woods. June—1. (B).

MEDEOLA, L. Indian Cucumber-root

2343. M. VIRGINICA, L.

Rich damp woods. June—1. (B).

TRILLIUM, L Wake Robin Birthroot.

2344. T. ERECTUM, L. var. ATROPURPUREUM. Hook.

T. erectum, L. of Gray's Manual.

Low rich woods. May 1. (B)

——var. ALBUM, Pursh

Occasionally found with the above of which it is only an albino form with greenish-white flowers.

2345. T. GRANDIFLORUM, Salisb. (Wake Robin.)

Rich woods. May—1. (B) Very variable.

2347. T. CERNUUM, L. (Nodding Trillium.)

Damp woods. Very local. Billings Bridge (*J. F.*) Casselman (*Wm. Scott*). May—1. Flower sweet-scented, recurved, on short pedicel.

2348. T. ERYTHROCARPUM, Mx. (Painted Trillium.)

Rich cool woods. Stewart's Bush. Beechwood. Casselman. May —2. (B). Petals striped with rose-purple at base, fruit an oval scarlet berry.

PONTEDERIACEÆ.—Pickerel-Weed Family.

PONTEDERIA, L. Pickerel-weed.

2355. P. CORDATA, L.

River sides, in shallow water. Along the banks of the Rideau River. July—4. (B).

HETERANTHERA, Ruiz and Pav.

2356. H. GRAMINEA, Vahl. (Water Star-grass.)

Schollera graminea, Willd.

In all slow-flowing waters. July—4.

JUNCACEÆ.—Rush Family.

JUNCUS, L. Rush.

2358. J. EFFUSUS, L. (Common Rush.)
Marshy ground. June—2. (B). Growing in large clumps, 3 feet high; panicle many flowered spreading, stamens 3.

2359. J. FILIFORMIS, L. (Slender Rush.)
River sides. Kettle Island. Hull. Britannia. July—2. (B). Stems very slender; panicle small, stamens 6.

2360. J. BALTICUS, Dethard, var. LITTORALIS, Engelm.
Sandy shore. Blue-berry Point, Aylmer. July—2. Flowers in a small loose panicle, dark brown, stems and leaves few and scattered, not forming clumps.

2372. J. TENUIS, Willd.
All low ground. June—2. (B). Growing in small tufts of erect stems about 1 foot high.

2374. J. BUFONIUS, L.
All low ground. July—2. (B). A small much branched slender annual, flowers greenish white.

2378. J. PELOCARPUS, E. Meyer.
On the banks of the Ottawa above Britannia. (*John Macoun**) Stems slender, erect, bearing 2 or 3 thread-like leaves and branching above into a compound spreading panicle of small flowers

2380. J. ALPINUS, Villars, var. INSIGNIS, Fries.
Muddy and gravelly places along the Canada Atlantic Ry. (*John Macoun**.) River banks, Skead's Mills. (*Wm Scott.*) Stems erect from a creeping rootstock, leaves 1 or 2, slender

2383, J. NODOSUS, L. var. *a* GENUINUS, Engelm.
River and Lake margins, common. July—2. (B). Stem erect, slender, bearing 2 or 3 leaves from a creeping tuber-bearing rootstock. Heads few, reddish brown, 8-20 flowered, overtopped by the involucral leaf.

2384. J. CANADENSIS, J. Gay, var. *a.* COARCTATUS, Engelm.
Low ground. Sandy lake margins. Kingsmere. Aug.—3. Stem slender, bearing 2-3 leaves. Panicle erect somewhat contracted, heads deep rich brown.

——var. *d.* LONGICAUDATUS, Engelm.

Stem short, rigid, panicle consisting of numerous greenish many flowered heads. Involucral leaf long and conspicuous. Mer-Bleue (*J.F.*) Casselman (*W. Scott*). Aug.—2.

This variety, Mr. F. V. Coville informs me, is now considered the type of the species.

LUZULA, DC. Wood-Rush.

2391. L. PILOSA, Willd. (Early Wood-Rush.)

L. vernalis, DC.

Sandy woods, Common. May—2. Pedicels 1-flowered in a loose umbel. Leaves hairy, lance-linear.

2392. L. CAMPESTRIS, Desv. var. *a.* VULGARIS, Hook.

Open woods. May—4. Flowers crowded, in ovoid spikes, some long-pedicelled others nearly sessile.

TYPHACEÆ.—Cat-tail Family.

TYPHA, Tourn.

2397. T. LATIFOLIA, L. (Cat-tail. Bulrush.)

Shallow water. June—3. (B).

2398. T. ANGUSTIFOLIA, L. (Slender Cat-tail.)

Pond to N. E. of Beechwood Cemetery. July 1, 1878. Two specimens only. Leaves ¼ inch wide, pistillate spike less than ½ inch in diameter, separated from the staminate portion.

SPARGANIUM, L. Bur-reed.

2399. S. EURYCARPUM, Engelm.

River and lake sides. June—2. (B). Stem stout, erect, branching. Fruiting heads 2-6, large, 1 inch in diameter.

2400. S. ANDROCLADUM, Morong. (MS.)

S. simplex, Huds. var. *androcladum*, Engelm.

River sides. Common in the Nation river at Casselman, (*J. Macoun**). St. Louis Dam (*J.F.*)

2401. S. SIMPLEX, Huds. (Smaller Bur-reed).

Shallow water. Malloch's Bay. Casselman. Billings Bridge. June—2. Much smaller than the above, flowering generally within a few inches of the water. Stems slender, erect, simple, fertile heads 1-4, only ½ inch across. Nutlets spindle-shaped.

MARINE BIOLOGICAL LABORATORY LIBRARY WOODS HOLE MASS.

ARACEÆ.—Arum Family.

ARISÆMA, Martins. Indian Turnip.

2405. A. TRIPHYLLUM, Torr. (Jack in the Pulpit.)

Rich low woods. Common. May—3. (B.)

CALLA, L. Water Arum.

2408. C. PALUSTRIS, L.

Swamps and margins of ponds and rivers. Common. May—3. (B.)

ACORUS, L. Calamus.

2411. A. CALAMUS, L. (Sweet Flag.)

Marshes and river margins. Abundant. June—2. (B.)

LEMNACEÆ—Duckweed Family.

LEMNA, L. Duckweed.

2412. L. TRISULCA, L.

Submersed in water. Very common. A very pretty plant for an aquarium. Several fronds usually grow attached together by slender stalks, in apparently trifoliate leaves. Inflorescence very rare here. Rootlets green, twisted.

2413. L. MINOR, L. (Lesser Duckweed.)

Floating on all stagnant water. Fronds almost round, rather thick, producing a single rootlet beneath. Young fronds produced from a cleft in the side of the frond. This curious plant may usually be found in flower if carefully looked for in warm undisturbed nooks in the latter half of June The inconspicuous flowers are pushed out from a cleft in the side of the frond and then turn upwards, when they may be detected by the colour of the anthers.

SPIRODELA.

2414. S. POLYRRHIZA, L (Large Duckweed.)

Lemna polyrrhiza, L.

Floating on all still waters. Easily distinguished from the above by the large fronds which are dark green above, purple beneath and bear several rootlets. I have never found this in flower.

WOLFFIA, Horkel.

2415. W. COLUMBIANA, Karsten.

Abundant in the St. Louis Dam, growing with *Lemna minor* and floating just beneath the surface film of the water. Fronds pale

green, loosely cellular, almost globular, about $\frac{1}{10}$ of an inch in diameter with a circular bordered opening beneath, no rootlets This genus is interesting as containing the smallest known flowering plants.

ALISMACEÆ.—Water-Plantain Family.

ALISMA, L. Water Plantain.

2417. A Plantago, L var. Americanum, Gray.

Ditches and marshes. Common. July. (B.)

SAGITTARIA, L. Arrow-head.

2418 S. variabilis, Engelm. (Arrow-leaf)

Margins of lakes and streams. A beautiful and most variable plant. Here I believe is a fine field for useful original work. The very different forms seem to be largely due to environment. With a little care seeds from the most marked forms could be collected and grown under different circumstances and the results recorded. We have here, common, all the four varities mentioned in Gray's Manual, 6th Edition.

——var. obtusa. Leaves large obtuse. Diœcious.

——var. latifolia. Leaves large, acute. Monœcious.

——var. angustifolia. Leaves with linear diverging lobes.

——var. diversifolia. Leaves, some lanceolate others sagittate.

2420. S. heterophylla, Pursh.

Muddy shallows. Common. Most of the leaves not at all sagittate or on one side only. Flowering stem weak, procumbent in fruit. We have all the 3 varieties mentioned in Gray's Manual.

——var. elliptica, Engelm. Leaves broad.

——var. rigida. Engelm. Leaves narrowly lanceolate, rigid.

——var. angustifolia, Engelm. Leaves nearly linear.

2421. S. graminea, Mx.

Gilmour's Piling Grounds, Hull. Leaves all submersed, grass-like.

NAIADACEÆ.—Pond-weed Family.

TRIGLOCHIN, L Arrow-grass.

2425. T. maritima, L

T. maritimum, L. var. *elatum*, Gray.

Peat-bog. At the Gas-spring, Mer Bleue and Casselman. A

tall plant with rush-like leaves and slender racemes of small green flowers which have much the general appearance of the fruiting spikes of *Plantago*.

SCHEUCHZERIA, L.

2426. S. PALUSTRIS, L,

Peat-bog. Rare Dominion Springs, Mer Bleue. June—2. A curious plant with creeping, jointed rootstocks, grassy leaves and simple zig-zag stems terminated by a loose raceme of 5 or 6 flowers.

POTAMOGETON, L. Pond-weed.

2428. P. NATANS, L.

Common in all waters. Floating leaves, all long-petioled, elliptical, coriaceous; submersed leaves (phyllodia) very narrow, grass-like. Spikes all emerged, cylindrical, densely flowered; fruits fleshy and swollen. Nutlet impressed on the sides.

——var. PROLIXUS, Koch.

This is only a form found in deep or flowing water, more slender in all its parts. I have never found it in fruit here.

2430. P. PENNSYLVANICUS, Cham

P. Claytonii, Tuck. *P. Nuttallii*, Ch. and Sch. (Morong.)

Very common. Stems compressed. Floating leaves nearly always produced in large numbers, opposite, 1—3½ inches long, 11—27 nerved, oblong, tapering into a short petiole. Easily recognized by the numerous 2-ranked, linear, 5-nerved, submersed leaves—the lateral nerves nearly marginal, the central space between the inner nerves coarsely cellular-reticulated and silvery.

2431. P. VASEYI, Robbins.

A slender delicate species, rare. In the Rideau Canal between Stewarton and the Exhibition Grounds, the very rare fruiting form with floating leaves may occasionally be found. Floating leaves obovate, 5-nerved, ¼ to ½ inch long, about the length of the filiform petioles. Spikes emerged, 3—9 flowered, interrupted. Submersed leaves thread-like, 1—1½ inches long.

2432. P. SPIRILLUS, Tuck.

Shallow water. Common in the Ottawa. Floating leaves generally freely produced, oval to lanceolate, from ½ to ¾ of an inch long, by

about $\frac{1}{4}$ inch wide on dilated petioles; submersed leaves narrowly linear, about 1 inch long. Submersed flowers one or two on very short peduncles. Emerged spikes $\frac{1}{4}$ to $\frac{1}{2}$ inch long, on peduncles of about the same length. Embryo coiled $1\frac{3}{4}$ times.

2435. P. FLUITANS, Roth.

P. lonchites, Tuck.

Common in running streams. Floating leaves long-elliptical, 3—6 inches long, acute, long-petioled, 17—23-nerved Submersed leaves very long, sometimes 12 inches by 1 wide, lanceolate and lance-linear, 7—15 nerved. Coarsely netted. Peduncles somewhat thickened upwards; spike cylindrical, fruit obliquely obovate, 3-keeled, the middle keel winged above. A form with remarkably long stipules and leaves is found at Hull. Whole plant frequently ruddy in colour. *P. rufescens*, Schrad. which has not yet been found here has lenticular fruit, short-petioled floating leaves, and the lower submersed leaves sessile.

2436. P. AMPLIFOLIUS, Tuck.

Not uncommon. The Ottawa River at Aylmer, Little Chaudiére and East Templeton. Kingsmere and Meech's Lake. A large foliaceous and beautiful species; submersed leaves lanceolate or oval on short petioles with the tips recurved and undulate at the edges, sometimes 7 inches long by 2 wide. Peduncles thickened upwards. Fruit large obovate, 3-keeled with a broad stout beak. Nutlet not impressed on the sides; embryo slightly incurved.

2437. P. HETEROPHYLLUS, Schreb.

P. gramineus, L. var. *heterophyllus*, Fries

Common and very variable according to the place where it grows. Stem slender, compressed, much branched below; floating leaves mostly thin, variable, rounded or sloping at the base, but with a short blunt point, 10—18-nerved, usually 1—2 inches long by $\frac{1}{2}$ to $\frac{3}{4}$ inch wide; submersed leaves linear-lanceolate, 7-nerved on the stem; 3-nerved on the branches; stipules obtuse, loose. Spike $\frac{3}{4}$—$1\frac{1}{4}$ inches long, fruiting freely. When growing on mud, sometimes with only broad coriaceous leaves.

——var. GRAMINIFOLIUS, (Fries) Morong.

The flaccid submersed leaves are very long 2—5 inches by 1—3

lines wide and the floating leaves are very seldom produced. Hull. Aylmer, Meech's Lake.

——var. LONGIPEDUNCULATUS. (Merat) Morong.

Submersed leaves 1—2 inches long and 2—3 lines wide sharp pointed. Internodes very long. Peduncles 3—6 inches long. Floating leaves ovate. Templeton. (*W. Scott.*) Meech's Lake. Kingsmere.

——var. MAXIMUS, Morong.

"All parts greatly elongated. Floating leaves often lanceolate and sharply pointed, 3—4 inches long and 6—14 lines wide. Submersed leaves 2—6½ inches long and 3—8 lines wide, 5—9 nerved." (*Morong.*) Specimens collected at Kettle Island were placed here by Mr. Morong.

2438. P. LUCENS, L.

Meech's Lake. This is the only actual record I have of this species. Leaves shining green, all submersed, short-petioled, oval or lanceolate, mucronate. Fruit roundish, compressed with obtuse margins, slightly keeled.

2439. P. ANGUSTIFOLIUS, Berch and Presl.

P. Zizii, Mertens and Koch.

Meech's Lake. Templeton. This resembles *lucens* in the green shining leaves; but is slenderer and has emersed floating leaves with petioles a little shorter than the blade.

2441. P. PERFOLIATUS, L.

Green's Creek. (*Dr. H. B. Small.**) Kettle Island. (*J. F.*) McLaurin's Bay, East Templeton. (*W. Scott.*) The type has orbicular ovate or shortly lanceolate leaves and short peduncles. It is decidedly rare at Ottawa.

——var. RICHARDSONII, A. Bennett (MS).

P. perfoliatus, L. var. *lanceolatus*, Robbins.

This is the common form at Ottawa; it has long lanceolate acuminate leaves, sometimes over 4 inches in length and the long peduncles are distinctly thickened upwards. (B.)

2442. P. ZOSTERIFOLIUS, Schum.

P. compressus, Fries.

Common. Stems flattened and winged. Leaves grass-like, abruptly pointed. (B.)

2444. P. FOLIOSUS, Raf.

P. pauciflorus, Pursh.

Billings Bridge. (*J. Macoun.**) Rideau Canal. Stem filiform, much branched. Leaves 1—2 inches long, narrowly linear, acute, obscurely 3-nerved, not glandular at base. Spikes capitate 1—4 flowered on short erect club-shaped peduncles; fruit roundish-lenticular, the back more or less crested.

2445. P. PUSILLUS, L.

Stem slender; leaves narrow, 1—3 nerved with translucent glands on each side at the base. Spikes 2—8 flowered on rather long peduncles, fruit obliquely elliptical, scarcely keeled, apex of embryo incurved and directed obliquely downwards. Very variable.

——var. PANORMITANUS, Biv.

Rideau Canal, very local. The most conspicuous difference from the type is the presence of spatulate floating leaves. Rev. Thomas Morong writes as follows of some specimens submitted to him:—"I have carefully compared these with plants sent me from Sicily as *P. pusillus*, L var. *panormitanus*, Biv., and can see no essential difference. In my specimens the submerged leaves are shorter, they are not ruddy at all, and none revolute. The description of the variety, however, corresponds: leaves longer (than the type), flaccid, the upper flowering ones opposite and spatulate, the whole surface of the leaf with a pretty chain-like areolation. I am sure that your plant meets this description, and when compared as to the floating leaves, the specimens agree. I should not, however, regard it as a distinct species, since it bears so many characters of *pusillus*. The ruddy tinge and revolute leaves may be owing to the season or accidental circumstances."

2446. P. MAJOR, (Fries) Morong.

P. mucronatus, Schrader, and *P. pusillus*, var *major*, Fries.

Not uncommon. Stem much less branching than *P. pusillus*, and more flattened, the leaves broader, often 5-nerved, and the flowering spikes interrupted.

2449. P. PECTINATUS, L.

Stems filiform, repeatedly branched so as to form brush-like mats in shallow water. Spikes interrupted, on long filiform peduncles

above the leaves. Very variable. Leaves narrowly linear, from fine setaceous to 3-nerved in one wide-leaved variety found at the Black Rapids.

2450. P. Robbinsii, Oakes.

A stiff dark-green plant growing in deep water and very rarely fruiting. Leaves linear, in two ranks, recurved, spreading. Meech's Lake. (*J.F.*) Buckingham. (*J. Macoun.*)

ZANNICHELLIA, Horned Pond-Weed.

2452. Z palustris, L.

A slender branching plant. Common. Growing under water, with opposite linear thread-like leaves, bearing monœcious flowers in the axils; nutlets, usually 4 together, elongated, beaked.

Naias, L. Naiad.

2455. N. flexilis, Rostk. and Schmidt.

A dwarf leafy plant growing on the bottom of ponds and streams. Common. Leaves linear, minutely serrulate, sessile, dilated at the base, somewhat crowded into whorls. Flowers solitary, axillary, sessile.

CYPERACEÆ—Sedge Family.

CYPERUS, L. Galingale.

2457. C. diandrus, Tor.

Low ground. Annual. Common. Spikelets flattened, dark brown.

2459. C. aristatus, Rottb.

C. inflexus, Muhl.

On gravelly or muddy river banks. Common. (B.) Spikelets at first yellowish, afterwards rusty-brown. Scales tapering to a long recurved point. A small diffusely spreading annual. Flowering plants may frequently be found half an inch high.

2461. C. esculentus, Linn.

C. phymatodes, Muhl.

River bank. Local. In abundance below Parliament Hill; along Bingham's Creek, Hull, and at Gatineau Point. Culm 1—2½ feet high. Umbel compound, much shorter than the long involucre; spikelets numerous, light straw coloured, 12—30 flowered. Roots bearing small nut-like tubers.

2462. C. STRIGOSUS, L.

In gravel along the Rideau River Rare. Somewhat like the above, the umbel less spreading, spikelets brighter coloured, 5—25 flowered. The culm swollen into a corm-like tuber at the base.

DULICHIUM, Pers.

2465. D. SPATHACEUM, Pers.

Marshes and banks of streams. Common. (B.) A perennial grassy plant with simple jointed stems, with leaves in 3 ranks and bearing the spikelets of green flowers in their axils.

HELEOCHARIS, R. Br. (*Eleocharis* of Gray's Manual.) Spike-rush.

2467. H. OBTUSA, Schultes.

H. ovata, R. Br.

Nation River at Casselman, and other places near Ottawa. (*J. Macoun.*) Annual, growing in tufts. Culms round, spikelet globose-ovoid, dull brown; scales very obtuse densely crowded in many ranks, tubercle flattened.

2468. H. PALUSTRIS, R. Br.

Wet meadows, in shallow water, etc. Common and very variable in size. The varieties have not been studied. Perennial with running rootstocks. Spikelet oblong lanceolate pointed, many-flowered.

2469. H. COMPRESSA, Sullivant.

Not uncommon. Growing in tufts. Culms flattened, spikelet ovate oblong 20—30 flowered. Achenes obovate pear-shaped, triangular, wrinkled; tubercle conical.

2417. H. INTERMEDIA, Schultes.

In mud along the shore of Leamy's Lake, near its outlet at Hull Cemetery, 1889. Moose Creek, 6 miles below Casselman. (*J. Macoun.*) Culms hair-like, wiry, tufted, from fibrous roots, spikelets oblong ovate. Loosely 10—20 flowered. A small species like *acicularis* but larger.

2473. H. ACICULARIS, R. Br.

Abundant in all muddy river banks. Culms hair-like forming close mats from running rootstocks Spikelets more or less flattened.

SCIRPUS, L. Club rush.

2478. S. PUNGENS, Vahl.

Rather uncommon. Banks of the Rideau, and at Aylmer and

April, 1894.

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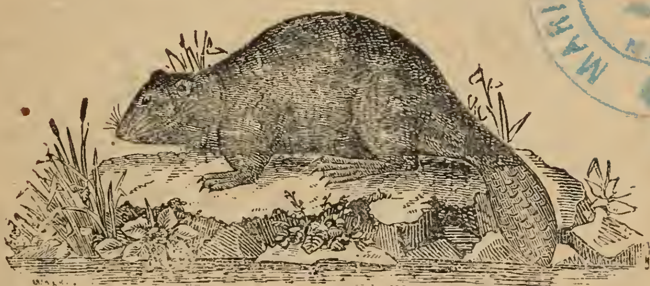

THE BEAVER *(Castor Canadensis*, Kuhl*)*.

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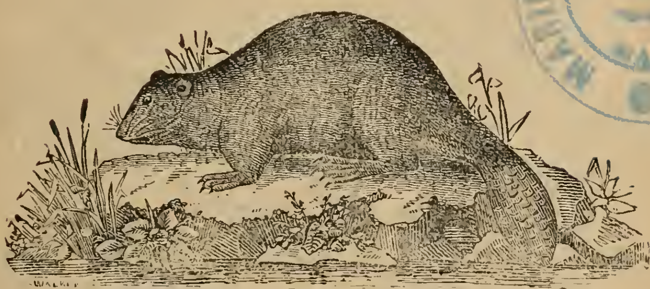

THE BEAVER (*Castor Canadensis*, Kuhl).

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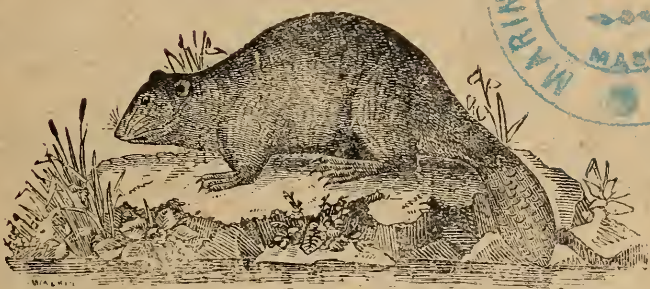

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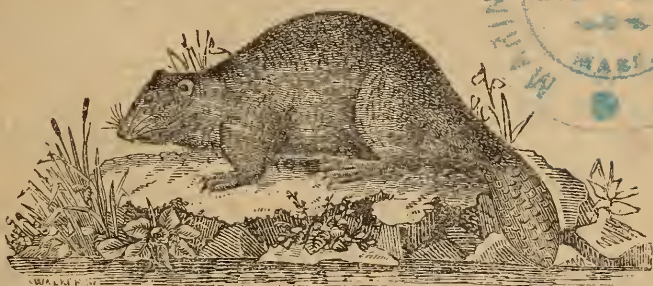

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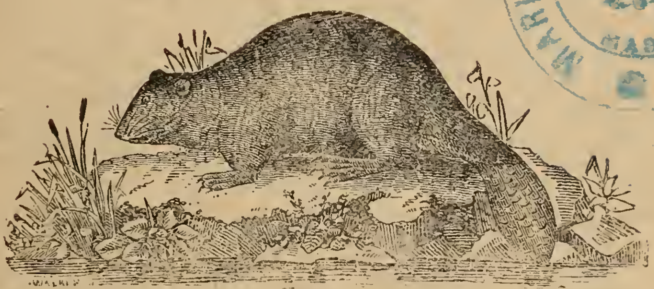

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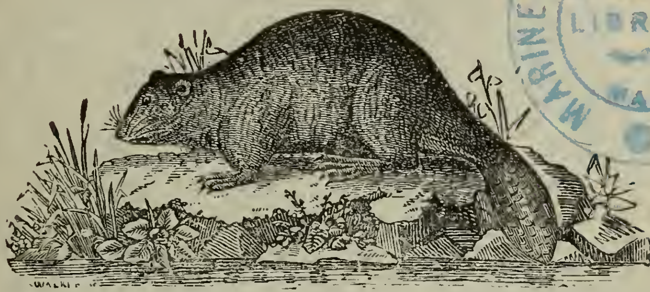

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SUMMARY

— OF —

Canadian Mining Regulations.

NOTICE.

THE following is a summary of the Regulations with respect to the manner of recording claims for *Mineral Lands*, other than Coal Lands, and the conditions governing the purchase of the same.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting, for mineral deposits, with a view to obtaining a mining location for the same, but no mining location shall be granted until actual discovery has been made of the vein, lode or deposit of mineral or metal within the limits of the location of claim.

A location for mining, except for *Iron*, shall not be more than 1500 feet in length, nor more than 600 feet in breadth. A location for mining *Iron*, shall not exceed 160 acres in area.

On discovering a mineral deposit any person may obtain a mining location, upon marking out his location on the ground, in accordance with the regulations in that behalf, and filing with the Agent of Dominion Lands for the district, within sixty days from discovery, an affidavit in form prescribed by Mining Regulations, and paying at the same time an office fee of five dollars, which will entitle the person so recording his claim to enter into possession of the location applied for.

At any time before the expiration of five years from the date of recording his claim, the claimant may, upon filing proof with the Local Agent that he has expended $500.00 in actual mining operations on the claim, by paying to the Local Agent therefor $5 per acre cash and a further sum of $50 to cover the cost of survey, obtain a patent for said claim as provided in the said Mining Regulations.

Copies of the Regulations may be obtained upon application to the Department of the Interior.

A. M. BURGESS,
Deputy of the Minister of the Interior

DEPARTMENT OF THE INTERIOR,
Ottawa, Canada, December 1892.

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